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University of the Philippines

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University of the Philippines

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A NUTRITIONAL EVALUATION OF SOME RATIONS FOR GROWING CHICKS [1]

G. O. Ranit

During the past decade a number of poultry nutrition studies have been conducted in the College of Agriculture at Los Baños to determine the comparative effects of different kinds of rations upon the growth, mortality, and feed utilization of S. C. White Leghorn and New Hampshire chicks raised up to 12 weeks of age. These rations are composed of different kinds and proportions of feed ingredients, most of which are products or by-products of local agricultural industries.

Recent advances in poultry nutrition have helped formulate efficient rations for growing chicks to meet the requirements for rapid growth, normal development of bones and the maintenance of normal health. The requirement of the chick for protein, fats, carbohydrates, vitamins, minerals and essential amino acids are now established and summarized in a report of the Committee on Animal Nutrition of the U. S. National Research Council (1954).

In order to make an intelligent formulation of chick rations it is of primary importance to know the requirement of the chick for various nutrients and the chemical composition of the ingredients that will compose the ration. However, the information is not always available and a necessary expedient is resorted to in that rations are compounded by trial-and-error and nutritional value and efficiency, measured by the growth response of the chicks.

Chick rations used in past studies were made up of only a few ingredients principally ground yellow corn, rice bran, copra meal, and fish meal. Common table salt was added in the amount of one per cent of the ration. From the nutritional standpoint, it is interesting to determine whether a practical-type ration for growing chicks composed of only 5 major ingredients would be adequate to meet the needs of the growing bird. It is the objective of this report to summarize and evaluate some studies in the College of Agriculture at Los Baños, using different kinds of chick rations to ascer-

[1] General Contribution No. 885.

tain the extent of improvement made to the present time in terms of growth or average weight at 12 weeks of age and feed efficiency or the amount of feed to produce a kilogram in body weight. These rations are classified as A, B, C, and D.

Ration A. This is the College standard ration for growing chicks. It has been used as the control ration in many studies conducted from 1948 to 1955. It consists of the following ingredients with all parts by weight:

Fine rice bran	55
Ground yellow corn	20
Shrimp or fish meal	20
Copra meal	5
Salt	1% of ration

One of the first studies using the College standard ration for growing chicks was that of Castillo (1948). He considered this ration as "the chick ration that has been giving satisfactory results." At 12 weeks of age the S. C. White Leghorn weanlings used in this study weighed 652.6 grams on the average and the amount of feed required for a kilo gain was 5.04 kilograms. These results were better than those obtained by Molina (1953) who reported an average weight of S. C. White Leghorn weanlings at 12 weeks of age of 609.4 grams and a feed conversion of 5.81 kilograms. The findings of Cammayo (1954) and Zamuco (1955) were much better than those in the two previous studies of Castillo and Molina. In Cammayo's study, the weight of the birds at the same age (12 weeks) was 678.7 grams with a feed efficiency of 4.47 kilograms, whereas in Zamuco's work, the S. C. White Leghorn weanlings averaged 782.0 grams with a feed conversion of 1.2 kilograms.

Using the same College standard ration as control lot for New Hampshires, Catalan and Bandong (1952) obtained at 12 weeks an average weight of 833.3 and 974.4 grams, respectively. The corresponding amounts to produce a kilogram body weight were 3.52 and 5.62 kilograms of feed. In 1953, different studies were reported by Tayag, San Juan, Villanoy, Pajarillaga, Katigbak, and Campos and Cruz using the same College standard ration as the control ration. These workers obtained an average 12-week weight of 823.2 grams for New Hampshire weanlings. The amount of feed required to

produce a kilogram weight gain averaged 4.96 kilograms, with the best efficiency reported by Villanoy and the poorest by Pajarillaga. These figures were 4.04 and 5.69 kilograms, respectively. For the weights at 12 weeks of age, Villanoy recorded the highest (1022.8 grams) and San Juan, the lowest (631.6 grams).

Almost the same trend of results was obtained in the 1955 studies of Alcasid, Agdigos, Gorrez, and Padlan who used the College standard brooding ration. New Hampshire chicks used in these studies averaged 887.0 grams at 12 weeks of age and the feed conversion was on the average 4.43 kilograms. In these four studies, Alcasid obtained the highest weight of 1060.9 grams and the most efficient utilization of feed of only 3.2 kilograms. The lightest birds were those of Gorrez who reported only 744.3 grams with 4.91 kilograms required to raise a weight gain of one kilo.

For all studies cited in this report with New Hampshires using the College standard ration for growing chicks, the average 12-week weight was 807.6 grams and the average feed conversion was 4.62 kilograms. For S. C. White Leghorns, the corresponding results were 680.7 grams and 4.88 kilograms. All these results are summarized in table 1.

TABLE 1.—*Average 12-week weights and amount of feed needed to produce a kilogram of body weight using Ration A*

SOURCE	AVERAGE 12-WEEK WEIGHT, GMS.		FEED EFFICIENCY, KG.	
	New Hamp.	S.C.W.L.	New Hamp.	S.C.W.L.
Castillo, 1948		652.6		5.04
Bandong, 1952	974.4		3.52	
Catalan, 1952	833.3		5.62	
Tayag, 1953	762.1		5.09	
San Juan, 1953	631.6		4.76	
Villanoy, 1953	1022.8		4.04	
Molina, 1953		609.4		5.81
Pajarillaga, 1953	764.1		5.69	
Katigbak, 1953	858.0		4.60	
Campos and Cruz, 1953	900.9		5.60	
Cammayo, 1954		678.7		4.47
Agdigos, 1955	809.6		5.88	
Gorrez, 1955	744.3		4.91	
Padlan, 1955	933.4		3.64	
Zamuco, 1955		782.0		4.2
Average	807.6	680.7	4.62	4.88

Although the same control ration (College standard) was used by different workers, there was a wide variation among the weights of the S. C. White Leghorns and New Hampshire weanlings raised to 12 weeks of age. This was so because the studies were conducted at different periods of the year. The variation in weights may also be attributed to management, systems of feeding and watering, and methods of brooding and rearing. The stock from which the chicks in the various studies came can likewise cause differences in weight performance and in efficiency of feed utilization. Even with the use of the same ration as control in the foregoing studies, the manner in which the individual ingredients which composed the ration were harvested, handled, stored, and transported during different seasons of the year may have affected the nutrient composition of the same ration.

Ration B. This is a brooding ration which was extensively used as control ration in many chick studies (unpublished) in 1956 and 1957. It is composed of the following ingredients with all parts by weight:

Fine rice bran	55
Ground yellow corn	20
Soybean oil meal	11.5
Copra meal	10.0
Fish meal	7.5
Salt	0.5% of ration
Aurofac	0.5% " "
Cod liver oil	0.5% " "
Fine ground oyster shell	1.0% " "

The effect of using ration B upon growth and feed utilization for S. C. White Leghorn and New Hampshire weanlings is shown in table 2. There was very little variation in the average 12-week weights of S. C. White Leghorn and New Hampshire chicks fed with Ration B. The over-all average weight for the New Hampshires was 1004.6 grams with 4.41 kilograms of feed needed to raise a kilogram gain in body weight. For the S. C. White Leghorns, these figures were 807.2 grams and 5.21 kilograms, respectively.

TABLE 2.—*Average 12-week weights and feed efficiency using Ration B*

SOURCE	AVERAGE 12-WEEK WEIGHT, GMS.		FEED CONVERSION, KG.	
	New Hamp.	S.C.W.L.	New Hamp.	S.C.W.L.
Anongos, 1956 [a]		813.9		4.84
Trillana, 1956 [b]	1018.3		4.15	
Agpalza, 1956 [c]		867.2		4.8
Villarta, 1956 [d]	1003.6		4.78	
Dacayanan, 1957 [e]		740.7		6.0
Salire, 1957 [f]	991.1		4.32	
Average	1004.6	807.2	4.41	5.21

[a] Anongos, Frederick C., "The influence of different levels of corn and rice bran feed on the rate of growth and mortality of chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1956. Unpublished).

[b] Trillana, Fidel P., "Cane molasses as an ingredient in a ration for growing chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1956. Unpublished).

[c] Agpalza, Santos G., "The feeding value of white flint and yellow flint corn in a ration for growing chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1956. Unpublished).

[d] Villarta, Federico G., "The effects of using soil immediately adjacent to piles of cow manure as a supplement in a brooding ration for chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1956. Unpublished).

[e] Dacayanan, Aurelio M., "The influence of fermented mash on the rate of growth and mortality of growing chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1957. Unpublished).

[f] Salire, Ramon S., "The effect of pepper (*Capsicum frutescens* Linn.) in the College growing ration on the growth and mortality of chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1957. Unpublished).

Ration C. Brooding ration C, or Padilla ration as it is known in the Department of Animal Husbandry, has also been used quite extensively lately as the control ration in chick experiments. It contains the following ingredients with all parts by weight:

Fine rice bran	25
Ground yellow corn	45
Copra meal	5
Soybean oil meal	14
Fish meal	10
Salt	0.5
Aurofac	0.5
Cod liver oil	2.0% of ration
Ground oyster shell	3.0% " "

To determine the effect of methionine upon the growth of New Hampshire chicks, Rivera (1958)[2] fed Ration C to her control birds. At 12 weeks of age the weanlings averaged 895.0 grams with a feed conversion of 4.65 kilograms. Using the same Ration C as control in another experiment, Mendoza (1958)[3] reported an average 12-week weight of 946.0 grams of New Hampshire males and females and the amount of feed required to produce a kilogram body weight was 3.81 kilograms. The results of both studies are shown in table 3.

TABLE 3.—*Average weight at 12 weeks and amount of feed required to raise a kilogram of body gain using Ration C*

SOURCE	NEW HAMPSHIRE	
	Weight (gms.)	Feed Efficiency (kg.)
Rivera, 1958	895.0	4.65
Mendoza, 1958	946.0	3.81
Average	920.5	4.25

Ration D. This ration which was very recently formulated is composed of the following:

Ingredient	*lb/ton*
Fine rice bran	300
Ground yellow corn	894
Soybean oil meal	300
Fish meal	200
Molasses	100
Corn gluten feed	100
Ipil-ipil leaf meal	80
Salt	10
Aurofac	10
Cod-liver oil	6

Using the foregoing ration as control in a recent nutrition study [4] in the College, the performance of chicks at 12 weeks was for New Hampshires, 1492.3 grams average weight, giving a feed conversion of 3.11 kilograms, and for S. C. White Leghorns, 1065.1 grams with

[2] Rivera, Josefina, "The effect of supplementing a growing ration with d-l-methionine." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1958. Unpublished).

[3] Mendoza, Erlando, "The use of African snail in rations for growing chicks." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1958. Unpublished).

[4] Ranit, G. O., "Limestone and powdered oyster shells as calcium supplements in rations for White Leghorn and New Hampshire chicks. Unpublished.

a feed efficiency of 4.07 kilograms. These results were confirmed in another recent study [5] using New Hampshire chicks. Table 4 allows a good comparison of Ration D with the other rations.

TABLE 4.—*Summary table comparing the effect of 4 brooding rations*

RATION	12-WEEK WEIGHTS (GMS.)		FEED EFFICIENCY (KG.)	
	N.H.	W.L.	N.H.	W.L.
A	407.6	680.7	4.62	4.88
B	1004.6	807.2	4.41	5.21
C	920.0	—	4.25	—
D	1492.3	1065.1	3.11	4.07

In terms of average weight at 12 weeks for New Hampshires, the 4 rations are ranked as follows: first, ration D; second, ration B; third, ration C; and fourth, ration A. For the White Leghorns, the ranking follows the same trend although this breed was not given ration C. As far as feed conversion is concerned, the most efficient ration was D, which required 3.11 kilograms of feed to produce a kilogram gain in body weight for New Hampshires and 4.07 kilos for S. C. White Leghorns.

NUTRIENT COMPOSITION OF RATIONS

The efficiency of a brooding ration depends upon its composition of nutrients and upon the right proportion that is needed most effectively to meet the various requirements of the body particularly for growth. To be able to evaluate the four rations from the nutritional standpoint, the composition of nutrients is presented in table 5.

TABLE 5.—*Calculated nutrient composition of rations (in per cent)*

NUTRIENT	RATION			
	A	B	C	D
Protein	22.6	21.1	21.0	21.1
Fat	10.6	9.9	6.6	5.1
Fiber	5.9	7.1	4.5	3.6
Calcium	1.7	0.5	1.7	1.2
Phosphorus	1.3	0.9	0.8	0.7
Calorie (per pound)	863.6	856.9	919.6	891.1
Calorie per 1 per cent protein	38.1	40.6	43.7	42.1

Protein. The protein content of the four rations is practically the same. Ration A, however, contains slightly higher protein than

[5] Ranit, G. O., "A comparative study of five brooding rations." Unpublished.

the other rations. The National Research Council requirement of 20 per cent total protein is recommended on the basis that the protein is of good quality. A good-quality protein should supply the right kind and quantity of amino acids which should not be very far from the requirement in order to attain a good efficiency in rate of growth and protein utilization. The amino acid composition of the four rations presented in this paper is shown in table 6.

TABLE 6.—*Calculated amino acid composition of rations (in per cent)*

AMINO ACID	RATION				
	A	B	C	D	NRC requirement
Arginine	1.41	1.25	1.35	1.20	1.2
Lysine	1.43	1.04	1.18	1.17	0.9
Methionine	.43	.30	.36	.40	0.45
Cystine	.26	.22	.27	.30	0.35
Tryptophane	.24	.77	.23	.22	0.20

From the calculated amino acid content of the rations it is evident that Ration D has almost the same amount as those recommended by the National Research Council for starting chicks. This is one of the reasons why New Hampshires and White Leghorns fed Ration D grow faster and have much better feed efficiency that those fed with the other rations.

Fat. The fat content of the four rations vary considerably. Ration A contains the highest (10.6 per cent) and Ration D, the lowest (5.1 per cent). Since it is a well-known fact that growing chicks cannot tolerate very much fat in their diets, rations containing very high amounts of fat are not very efficient rations. Vermeulin as cited by Ewing (1951) pointed out that excessive fat caused a detrimental effect on the growing bird. The better performance of the weanlings in terms of growth and feed utilization may be attributed to the low fat content of Ration D. This amount is the usual quantity of fat present in poultry brooding mashes.

Fiber. Crude fiber is not digested well by chicks. Table 5 shows that Rations A, B, and C have a higher fiber content than Ration D, which may have contributed to the lower average weight of New Hampshire and S. C. White Leghorn chicks at 12 weeks of age. As pointed out by Ewing (1951) from a report by the Oklahoma Agricultural Experiment Station, the growth of chicks fed rations containing 7, 10, and 12 per cent was slow. This report

further indicated that the rate of growth was decreased as the fiber content increased.

Calcium and phosphorus. The right amount and proportion of calcium and phosphorus in a growing ration must be carefully considered. A calcium-phosphorus ratio of 2:1 would effect a better utilization of these elements by chicks. Ration D contains 1.2 per cent of calcium and 0.6 per cent of phosphorus or a ratio of 2:1. These amounts of calcium and phosphorus in Ration D are almost the same as those recommended by the National Research Council of 1.0 and 0.6 per cent, respectively. Except for Ration C, the ratio of calcium to phosphorus in Rations A and B does not conform to the recommended ratio of 2:1; hence, the two rations were not as efficient as Ration D.

Calorie-protein ratio. Efficient poultry rations are usually expressed in terms of the relationship of calorie to protein. While the calorie-protein ratios of the four rations may conform with accepted values, the best ratio, however, depends upon the quality of amino acid in the protein of the ration. Ration D is composed of amino acids the amounts of which are almost the same as those recommended by the National Research Council. The 42.1 calories per 1 per cent protein requirement is within the accepted level of 42-43 calorie-protein ratio for growing chicks. The other rations either have too high or too low calorie content in relation to protein.

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* * *

Science is truly an expensive investment, but the dividends that we may reap from it in the form of increased production, better health and better living are priceless assurances for the peace and happiness of the nation.

—*R. R. Angeles*

* * *

Research is doing one's damnedest with one's mind, no holds barred.

—*P. W. Bridgmen*

SOIL FERTILITY-CORN POPULATION TEST IN NORTHERN AND SOUTHERN LUZON PROVINCES [1]

N. L. Galvez and Romeo C. Bruce [2]

Fertility-plant population tests at the BPI regional station at Ilagan, Isabela, and Lamao, Bataan, and at the San Miguel Seed Farm in Calauan, Laguna, showed that a population density of 40,000 to 60,000 plants per hectare fertilized with 45 to 90 kg. N per hectare gave good yield of Philippine hybrid corn #3, yellow flint.

The original organic matter contents of the soil, which ranged from 1.39 to 2.04 per cent, indicate that there was not sufficient nitrogen to supply the requirement of the corn. There was no response to phosphorus and potassium.

The yield increments at Lamao and Calauan tests were much higher than that at Ilagan suggesting that Lamao and Calauan soils could make more substantial progress in producing corn through proper combination of plant population and nitrogen fertilization than Ilagan soils.

Soil fertility and good seeds have their limitations. When other factors are not in their optimum conditions for plant growth and development, farming becomes an unprofitable enterprise.

A soil can give the best result only when the concentration of its available nutrients is sufficient to supply the requirement of the growing crops under optimum conditions for crop production. The needed amount depends on the number of plants per unit area. If the number of plants in a unit area is too dense, the plants become chlorotic and slender. On the other hand, if the unit area is thinly populated, the yield is not at maximum although the plants appear healthy and vigorous.

The uncertainty of genetic composition of open-pollinated varieties of corn intensively and extensively used in many corn growing regions in the Philippines has in part rendered inadvisable studies on increased plant population and higher rates of fertilization. With

[1] Central Experiment Station Contribution No. 1975. Part of Project 881 financed by a grant from the NARIC. Cooperative corn fertilizer test of the U. P. College of Agriculture, Bureau of Plant Industry, and San Miguel Brewery Company, Inc. Messrs. E. Gianzon and O. Cruz of the Lamao Experiment Station, T. Eugenio of the Ilagan Experiment Station and A. Rillo of the San Miguel Brewery Company, Inc., participated in the work.

[2] The authors acknowledge the help of Dr. Lyle E. Nelson, former Cornell visiting professor in the Department of Soils, in carrying out the work.

the increasing use of hybrid seeds of a consistently superior quality, a study of this nature may be of a more paramount utility.

Increased corn yield in the United States was obtained mainly from the use of fertilizers and optimum number of hybrid corn population per unit area.

In the Philippines, striking corn yield response to the application of nitrogenous fertilizers has been established by Galvez *et al.* (1955). In loam soils which have been under cultivation for at least fifty years, an increase of 13 to 36 cavans (56 kg./cav.) of shelled corn per hectare with the split application of 45 kg. N was obtained. Galvez *et al.* (1956) found that in Lalakay, Los Baños, Laguna, the average yield of shelled corn increased with rates of nitrogen application. The yields at O-N, 45-N and 90-N were 22.3 cavans, 47.9 cavans and 59.1 cavans per hectare, respectively. In Maquiling, Calamba, Laguna, a parallel trend of results was obtained. It was also reported that the nutritive elements, nitrogen and phosphorus in the grains, were augmented, too.

The yield of stover as well as its nitrogen and phosphorus contents have also been enhanced by the increased rate of nitrogen added to it.

Jordan and Krantz as cited by Jones and Rogers (1949) reported that an adequate number of plants per acre is essential for maximum yields. Krantz obtained yields of 53, 82 and 93 bushels (25.4 kg./bu.) of corn from plant populations of 4,000, 9,000 and 13,000 per acre (0.4047 ha.), respectively.

According to Jones and Rogers (1949) Brooks found no increase in yield for plant population above 10,000 plants per acre even when given adequate amount of phosphorus and potassium and rates of nitrogen up to 150 lbs. per acre.

This work was conducted to determine the effects of different rates of application of nitrogen, plant population and season on the yield of Philippine hybrid corn No. 3. It was carried out at the different regional stations of the Bureau of Plant Industry in cooperation with the representatives of the BPI. An additional experiment was also conducted in Calauan, Laguna, in cooperation with the representative of the San Miguel Brewery Company, Inc.

MATERIALS AND METHODS

The chemical analysis of the soil samples collected at the sites of the test is given in table 1a.

TABLE 1a.—*Properties of soil samples from sites of experimentation*

CHEMICAL ANALYSIS	ILAGAN, ISABELA SAN MANUEL SANDY LOAM RECENT ALLUVIUM (CF-34)	LAMAO, BATAAN CLAY LOAM RECENT ALLUVIUM (CF-32)	CALAUAN, LAGUNA SANDY LOAM RECENT ALLUVIUM (CF-29)
pH	6.4	5.45	6.34
O.M. %	2.04	1.39	1.61
Truog P, ppm	41.88	17.8	141
Exchangeable K, ppm	156	229	244

No liming was done since the reaction, 5.45-6.4 of the soils at these three sites was above the minimum pH for optimum growth and development of corn. Spurway (1941) gave pH 5.5 and McIlvaine and Pohlman (1949) pH 5.1, as lower limits for optimum growth of corn.

Philippine hybrid No. 3 yellow flint was used in all the experimental sites.

Nitrogen was supplied by ammonium sulfate containing 20 per cent N; phosphorus, by superphosphate containing 18 per cent P_2O_5; potassium, by muriate of potash containing 60 per cent K_2O.

The design of the experiment was a split plot with fertilizer treatment as the main plot and population as the subplot. The lay-out may be gleaned from table 1b.

Subplots were 5 × 10 m. One-half of the nitrogen and all of P and K were applied in the row at planting and the remaining half of nitrogen, as side-dressing when the plants were knee high.

TABLE 1b.—*Grain yields (15% moisture) in cavans per hectare at Ilagan Station, dry season* [a]

FERTILIZER *kg./ha.*	POPULATION (PLANTS/HA)			TREATMENT MEAN
	20,000	40,000	60,000	
0–60–60	25.0	28.3	21.0	24.8
45–60–60	34.6	40.8	43.0	39.5
90–60–60	31.7	40.7	62.6	45.0
90–60–0	40.2	55.4	50.5	48.7
90–0 –60	24.5	46.5	50.9	40.7
135–60–60	31.4	49.7	48.9	43.3
Population means	31.2	43.6	46.2	

[a] Planted on March 7, 1957 and harvested on May 13, 1957.

	L.S.D. 5%	1%
Fertilizer means	11.1	15.4
Population means	7.8	11.8
Population means within fertilizer treatment	14.4	18.7
Fertilizer means within population treatment	13.1	17.9

RESULTS AND DISCUSSION

Response to treatment and population at Ilagan Station (CF-34). Table 1b shows that increase in yield was apparently due to nitrogen and tended to be associated with the rates of application of nitrogen. This indicates that 2.04 per cent organic matter content of the soil in the control plot was not sufficient to supply the nitrogen requirement of the corn plants. Galvez *et al.* (1955) reported that southern Luzon soils containing 1.14 to 2.41 per cent organic matter, responded readily to the application of nitrogen. Phosphorus and potassium did not affect the yield of grains consistently.

During the dry season crop, the treatment mean yield on over-all populations was 24.8 cavans at O-N; 39.5 cavans at 45-N; 44.8 cavans at over-all 90-N; and 43.3 cavans at 135-N.

The population mean yield showed results parallel to the treatment yield. The mean yields on over-all treatments were 31.2 cavans, 43.6 cavans and 46.2 cavans per hectare for 20,000, 40,000 and 60,000 plant population, respectively.

There was a positive interaction between population and treatments. The data seem to indicate that the most profitable result could be obtained when a hectare of soil, fertilized with 90 kg. N, contains 40,000 plants.

Although the yields in the wet season showed close parallelism with those of the dry season, they contrast in that the differences between yields due to treatment were not significant (table 1c). It was noted that although the rainfall at the time was favorable for the growth and development of the crops the stand of the plants was very much lower than the previous crop due to the heavy injury from the stem borer and ear worm.

The treatment mean yields were 12.7 cavans for O-N, 16.2 cavans for 45-N, 13.7 cavans for 90-N, and 15.4 cavans for 135-N.

The population yields for 20,000 was only 10.9 cavans; for 40,000, 15.4 cavans, and for 60,000, 16.4 cavans. The differences were significant.

TABLE 1c.—*Grain yields (15% moisture) in cavans per hectare at Ilagan Station, wet season* [a]

FERTILIZER *kg./ha.*	POPULATION (PLANTS/HA)			TREATMENT MEAN
	20,000	40,000	60,000	
0–60–60	11.6	13.2	13.2	12.7
45–60–60	14.5	14.9	19.4	16.2
90–60–60	9.7	16.0	19.5	15.1
90–0 –60	11.2	17.5	15.7	14.8
90–60–0	8.1	11.8	13.7	11.2
135–60–60	10.4	18.8	17.2	15.4
Population means	10.9	15.4	16.4	

[a] Planted on June 20, 1957 and harvested on Sept. 24, 1957.

	L.S.D. 5%	1%
Fertilizer means	N.S.	N.S.
Population means	2.2	3.3
Fertilizer × population	N.S.	N.S.

This suggests that the efficiency of treatment and population is affected by season. It may have a direct effect on yield and an indirect effect in that it modifies susceptibility of plants to insect pests.

Statistical treatments of the two-season results showed that season influenced significantly the effects of treatments and population (table 1d). It may be less complicated to interpret the data only according to season. The dry season mean yield is significantly higher than that of the wet season.

TABLE 1d.—*Dry and wet seasons results*

FERTILIZER *kg./ha.*	POPULATION (PLANTS/HA)									TREATMENT MEAN
	20,000			40,000			60,000			
	1957D	1957W	MEAN	1957D	1957W	MEAN	1957D	1957W	MEAN	
0–60–60	25.0	11.6	18.3	28.3	13.2	20.8	21.0	13.2	17.1	18.7
45–60–60	34.6	14.5	24.6	40.8	14.9	27.9	43.0	19.4	31.2	27.9
90–60–60	31.7	9.7	20.7	40.7	16.0	23.4	62.6	19.5	41.1	30.1
90–0 –60	40.2	11.2	25.7	55.4	17.5	36.4	50.5	15.7	33.1	31.7
90–60–0	24.5	8.1	16.3	46.5	11.8	29.2	50.9	13.7	32.3	25.9
135–60–60	31.4	10.4	20.9	49.7	18.8	34.3	48.9	17.2	33.1	29.4
Population means	31.2	10.9	21.1	43.6	15.4	29.5	46.2	16.4	31.3	27.3

	H.S.D. 5%	1%
Treatment	9.38	11.83
Population	3.83	4.89
Season	2.28	3.03

Response to treatment and population at Lamao Station (CF-32). At Lamao Station, the dry-season test showed a significant response to nitrogen (table 2a). The soil at the station contained only 1.61 per cent organic matter. This amount is much lower than the amount found in Ilagan soil which responded well to the application of nitrogen. As the rate of nitrogen fertilization was increased, the yields increased, too. Inconsistent effects of phosphorus and potassium were indicated. In this connection, it may be of interest to note that the soils of this station contain 19.5 ppm, Truog P and 229 ppm exchangeable potassium. Of the plot tests conducted by the Department, soils with an amount of P and K around these figures did not show a true response to the application of phosphorus and potassium.

TABLE 2a.—*Grain yields in cavans per hectare at Lamao Station, dry season* [a]

FERTILIZER [b] *kg./ha.*	POPULATION (PLANTS/HA)			TREATMENT MEAN
	20,000	40,000	60,000	
0–60–60	28.6	27.4	18.3	24.8
45–60–60	39.9	58.6	56.5	51.7
90–60–60	37.9	67.0	77.2	60.7
90–60–0	46.5	75.3	74.6	65.5
90–0 –60	45.6	65.6	73.9	61.7
135–60–60	47.9	68.5	85.1	67.2
Population means	41.1	60.4	64.3	

[a] Planted on Nov. 28, 1956 and harvested on March 7, 1957.
[b] Fertilizer, population, and fertilizer × population effects significant at one per cent.

	5% L.S.D.
Fertilizer means	10.4
Population means	10.8
Population means within fertilizer treatment	15.8
Fertilizer means within population treatment	11.5

At 0-, 45-, 90- and 135-N, the corresponding yields of shelled corn at over-all population were 24.8 cavans, 51.7 cavans, 62.6 cavans and 67.2 cavans.

The population mean yield on over-all treatments showed increases with population. With 20,000 plants per hectare the yield was 41.1 cavans; with 40,000 plants, 60.4 cavans; with 60,000 plants, 64.3 cavans.

Interaction between fertilizer and population was significant. In the test, the combination of 40,000 to 60,000 plants and 45 kg. N to 90 kg. N per hectare was the best.

In the wet season, the treatment and population effects on yields show close parallelism with the dry-season data (table 2b).

The treatment means on over-all populations reached its peak yield with the application of 45 kg. N per hectare. This does not however, fully corroborate the dry-season results which reached the peak yield only after the application of 135 kg. N per hectare.

At 0-, 45-, 90- and 135-N, the mean yields on over-all populations were 30.5 cavans, 60.7 cavans, 58.3 cavans and 59.5 cavans, respectively.

TABLE 2b.—*Grain yields (15% moisture) in cavans per hectare at Lamao Station, wet season* [a]

FERTILIZER *kg./ha.*	POPULATION (PLANTS/HA)			TREATMENT MEAN
	20,000	40,000	60,000	
0–60–60	27.9	34.7	29.0	30.5
45–60–60	47.3	66.3	68.7	60.7
90–60–60	38.3	57.3	67.9	54.5
90–60–0	41.7	59.1	78.3	59.7
90–0 –60	46.0	64.1	71.7	60.6
135–60–60	48.3	59.4	71.0	59.5
Population means	41.6	56.8	64.4	

[a] Planted on June 8-9, 1957 and harvested on Oct. 3, 1957.

	L.S.D. 5%	1%
Fertilizer means	10.0	13.9
Population means	7.6	8.4
Fertilizer × population	N.S.	N.S.

The population mean yields on over-all nitrogen levels were 41.6 cavans for 20,000 plants, 56.8 cavans for 40,000 plants and 64.4 cavans for 60,000 plants.

Unlike the dry-season test, the wet-season test failed to show significant interaction between fertilization and population. In the test, the best combination was 40,000 to 60,000 plants per hectare with 45 kg. N to 90 kg. N.

Combined statistical treatment of the yields for the 1957D and 1957W shows that season did not affect the yield significantly (table 2c). Treatments increased the yields significantly and had no interaction with the season indicating that the increase is independent of the season.

TABLE 2c.—*Dry and wet season results*

FERTILIZER kg./ha.	POPULATION (PLANTS/HA) 20,000 1957W	1957D	MEAN	40,000 1957W	1957D	MEAN	60,000 1957W	1957D	MEAN	TREATMENT MEAN
0–60–60	27.9	28.6	28.3	34.7	27.4	31.1	29.0	18.3	23.7	27.7
45–60–60	47.3	39.9	43.6	66.3	58.6	62.4	68.7	56.5	62.6	56.2
90–60–60	38.3	37.9	38.1	57.3	67.0	62.2	67.9	77.2	72.6	57.6
90–60–0	41.7	46.5	44.1	59.1	75.3	67.2	78.3	74.6	76.4	62.6
90–0 –60	46.0	45.6	45.8	64.1	65.6	64.9	71.7	73.9	72.8	61.2
135–60–60	48.3	47.9	48.1	59.4	68.5	64.0	71.0	85.1	78.1	63.4
Population means	41.6	41.1	41.3	56.8	60.4	58.6	64.4	64.3	64.4	54.8

	H.S.D. 5%	1%
Treatment	15.2	19.1
Population	4.4	5.5
Season	N.S.	N.S.

Population effect on the yield is highly significant. There was no interaction between population and season. Population-treatment interaction was highly significant suggesting that population and treatment are the main factors in getting high yield of Philippine hybrid No. 3, yellow flint. In areas where the soil is similar to the Pilar clay loam at the Lamao station, 40,000 to 60,000 plants treated with 45 kg. N to 90 kg. N per hectare could be expected to produce optimum yield.

Response to treatment and population at Calauan (CF-29). In Calauan, Laguna, Philippine hybrid No. 3, yellow flint showed a highly significant response to nitrogen (tables 3a and 3b). The application of phosphorus and potassium had no consistent effect. These results are in full accord with the response of Philippine hybrid No. 3, yellow flint at Ilagan and Lamao regional stations of the Bureau of Plant Industry.

TABLE 3a.—*Grain yields (15% moisture) in cavans per hectare at Calauan, wet season* [a]

FERTILIZER kg./ha.	POPULATION (PLANTS/HA) 20,000	40,000	60,000	TREATMENT MEAN
0–60–60	14.5	23.2	9.7	15.8
45–60–60	38.9	55.0	47.7	47.2
90–60–60	45.2	63.8	62.8	57.3
90–60–0	40.5	62.9	74.5	59.3
90–0 –60	42.3	64.2	64.9	57.1

135–60–60	38.5	56.9	62.1	52.5
180–60–60	41.6	61.9	65.4	56.3
Population means	37.4	55.4	55.3	

[a] Planted on June 19-27, 1957 and harvested on Sept. 30, 1957. Data taken from the theses of R. Caburubias and A. Gomez (1958).

	L.S.D. 5%	1%
Fertilizer means	5.5	7.5
Population means	4.2	N.S.

TABLE 3b.—*Grain yields (15% moisture) in cavans per hectare at Calauan, dry season* [a]

FERTILIZER *kg./ha.*	POPULATION (PLANTS/HA) 20,000	40,000	60,000	TREATMENT MEAN
0–60–60	27.6	26.0	16.6	23.3
45–60–60	42.8	65.9	63.4	57.4
90–60–60	45.5	78.2	81.0	68.2
90–60–0	46.7	79.2	86.9	70.9
90–0 –60	38.9	77.3	82.9	66.4
135–60–60	42.0	75.9	87.3	68.4
180–60–60	49.1	78.7	95.1	74.3
Popultion means	41.8	68.7	73.3	61.3

[a] Planted on Nov. 14, 1957 and harvested on March 14, 1958.

	L.S.D. 5%	1%
Fertilizer means	6.0	8.1
Population means	3.6	5.1
Population means within fertilizer treatment	7.6	10.0
Fertilizer means within population treatment	8.1	10.8

In the wet season of 1957 the treatment means on over-all populations were 15.8 cavans, 47.2 cavans, 57.9 cavans, 52.5 cavans and 56.3 cavans per hectare for 0-, 45-, 90-, 135-, and 180-N, respectively. These findings suggest that a plant population ranging from 40,000 to 60,000 coupled with 90 kg. N per hectare is the best combination for obtaining the best result.

The statistical treatment of the dry- and wet-season results revealed that season is a significant factor in the effectiveness of the combined effects of fertility and plant population (table 3c). Data, then, would reveal more precise information when seasonal data are used instead of the combined data.

TABLE 3c.—*Dry and wet seasons results*

FERTILIZER kg./ha.	POPULATION (PLANTS/HA) 20,000 1957W	1958D	MEAN	40,000 1957W	1958D	MEAN	60,000 1957W	1958D	MEAN	TREATMENT MEAN
0–60–60	14.5	27.6	21.1	23.2	26.0	24.6	9.7	16.6	13.2	19.6
45–60–60	38.9	42.8	40.9	55.0	65.9	60.4	47.7	63.4	55.6	52.3
90–60–60	45.2	45.5	45.4	63.8	78.2	71.0	62.8	81.0	71.9	62.8
90–60–0	40.5	46.7	43.6	62.9	79.2	71.1	74.5	86.9	80.7	65.1
90–0 –60	42.3	38.9	40.6	64.2	77.3	70.8	64.9	82.9	73.9	61.8
135–60–60	38.5	42.0	40.2	56.9	75.9	66.4	62.1	87.3	74.7	60.4
180–60–60	41.6	49.1	45.4	61.9	78.7	70.3	65.4	95.1	80.2	65.3
Population means	37.4	41.8	39.6	55.4	68.7	62.1	55.3	73.3	64.3	55.3

	L.S.D. 5%	1%
Treatment	5.79	7.02
Population	3.29	4.15
Season	1.74	2.29

An evaluation of the fertility-plant population results show that Lamao and Calauan soils produced much higher increments than Ilagan soils (table 4a).

TABLE 4a.—*Yield increment in cavans per hectare*

N RATE IN KG./HA.	INCREMENT ILAGAN	LAMAO	CALAUAN
1st 45	9.2	28.5	32.7
2nd 45	1.3	4.3	10.9
3rd 45	0.2	2.9	–2.8
4th 45	—	—	4.9

At Ilagan, the first 45 kg. N gave an increment of 9.2 cavans; the second, 1.3 cavans; the third only 0.2 cavan. In the same order, the increments at Lamao were 28.5, 4.3 and 2.9 cavans and at Calauan, 32.7, 10.9 and – 2.8 cavans. The fourth 45 kg N at Calauan gave an increment of only 4.9 cavans (table 4a).

At Ilagan, the increments due to 20,000 increments in population were 8.4 cavans for the first and 1.8 cavans for the second; in the same order, at Lamao, 17.3 and 5.8 cavans; at Calauan, 22.5 and 2.2 cavans (table 4b).

TABLE 4b.—*Yield increment in cavans per hectare based on the yield of 20,000 plants*

PLANT POPULATION IN 1000	INCREMENT ILAGAN	LAMAO	CALAUAN
40	8.4	17.3	22.5
60	1.8	5.8	2.2

A critical study of the over-all increments reveal that Ilagan soil was the least responsive and Calauan soils, the most responsive to the soil management practices. This suggests too that areas in the vicinity of the experimental sites in Lamao and Calauan having similar properties and climatic conditions should be given preference for corn production over soils with similar properties and climatic conditions at the Ilagan site. Under the conditions of the test more substantial progress could be made in increasing corn yield in Lamao and Calauan than in Ilagan.

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In ten years at most we must cover the distance which separates us from the advanced countries of capitalism. . . Look into everything, let nothing escape you, learn and learn more. . . We must study technology, master Science.

—*J. Stalin*

EFFECTS OF CERTAIN STORAGE FACTORS ON THE MILLING RECOVERY OF MILFOR 6(2) [1]

D. L. Umali, R. M. Payson and I. S. Santos

Rough rice of Milfor 6(2) stored at 13.6 and 11.5 per cent moisture content then milled after eight months gave about seven per cent more milled rice than rough rice stored at 19.8 and 17.5 per cent moisture, and about three to four per cent more than that stored at 15.7 and 9.8 per cent moisture.

There were no significant differences in milled rice yields among lots of rough rice stored for eight months in cheesecloth bags, wooden boxes, and jute sacks at 11.8 per cent moisture.

Storage of rough rice with 11.5 per cent moisture for one to two months in mason jars and in jute sacks resulted in more milled rice. There was no further increase or decrease in milled rice up to the tenth month of storage.

The milling recovery of rice is affected by several factors such as growing conditions in the field, weather conditions at harvest time, moisture content at harvest, temperature and rate of drying, moisture during storage, length and method of storage, and moisture content and temperature of rough rice at milling. In this study, only moisture content of rough rice at storage, container used for storing, and length of storage were considered.

The study was conducted from December, 1955, to March, 1957, at the Division of Plant Breeding, Department of Agronomy, U.P. College of Agriculture.

Collier [2] and Davis [3] suggested that for safe storage, bulk rice should contain not more than 14 per cent moisture.

Davis also observed that storage in sacks was safe when the moisture content was reduced to 15 per cent; that sack drying is less expensive but more inconvenient than bulk drying; that no compensation was made for variations in moisture content of rough rice in different sacks.

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[1] Central Experiment Station Contribution No. 1976.
[2] G. A. Collier, *United States Dept. Agric. Misc. Publ. No. 615* (1947).
[3] L. L. Davis, *California Agric. Ext. Serv. Cir.*, **163** (1950).

Data taken at the Crowley Station [4] show that it is dangerous to keep rice with a moisture content of over 14 per cent over 12 to 24 hours. The maximum moisture content for bulk storage of less than 6 months is probably 13.5 per cent, and for over 6 months, about 12 per cent.

Reynolds [5] reported that rough rice could be stored satisfactorily in wooden or concrete bins, and "Haydite" construction during cool weather for one to four months. He found that when two lots of rice were stored in 20-barrel galvanized metal cisterns for 10 months, no change in the official grade and milling quality occurred. Both lots, however, increased in fat rancidity.

In southern Louisiana [6] it was noted that respiration is a factor of considerable importance where rice is stored in bulk.

When the milling process is completed and the by-products are removed, the rice that is left is referred to as total clean rice.[7] This rice is classified according to the extent of breakage into fancy rice (or head rice), second heads, screenings, and brewer's rice. Fancy rice includes whole grains and broken rice one-half to three-fourths in grain size; screenings, broken rice one-fourth to one-half in grain size; and brewer's rice, less than one-fourth in grain size.

MATERIALS AND METHODS

Rough rice of the variety Milfor 6(2), taken from the crop harvested in December, 1955, was threshed and cleaned of dirt and empty grains with the use of an ordinary blower.

A universal electronic moisture tester was used in determining moisture content. Three experiments were made for each moisture-content determination.

The hulls of the rough rice were removed with the McGill Sheller; the bran layer of the hulled rice, with the McGill No. 3. Brewer's rice was separated from milled rice with the use of aluminum sieves. Bran, hulls, and brewer's rice were separated from each other with the South Dakota Seed Blower.

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[4] Anonymous, *Southern Cooperative Series Bull.*, **29** (1953).
[5] E. B. Reynolds, *Texas Agric. Exper. Sta. Bull.*, **775** (1954).
[6] Anonymous, *Louisiana Bull.*, **416** (1947).
[7] M. W. Slusher and T. Mullins, *Arkansas Agric. Exper. Sta. Bull.*, **526** (1952).

Experiment 1

Moisture content at storage. A lot of Milfor 6(2) with 22.8 per cent moisture was alternately sun-dried and air-dried until the desired moisture contents were reached. Drying from 11.8 per cent to 9.8 per cent was accomplished by using a Fisher-Forced-draft oven at about 50°C. This temperature was found suitable for artificial drying by Umali, Silverio, and Santos.[8]

Samples at varying moisture contents (19.8, 17.5, 15.7, 13.5 11.5, and 9.8 per cent) were kept in mason jars. The rice was milled after eight months of storage. Three trials of 1000 grams each were made for each moisture content.

Experiment 2

Method of storage. A lot of Milfor 6(2) with a moisture content of 21.6 per cent was alternately sun-dried and air-dried until moisture content was down to 11.8 per cent. The rough rice was then stored in jute sacks, cheese-cloth bags, and wooden containers. The rice was milled after eight months of storage. Three trials of 1000 grams each were made for each method.

Experiment 3

Length of storage. A portion of the lot of Milfor 6(2) used for the study of method of storage was used. The rough rice was dried down to a moisture content of 11.5 per cent. Mason jars (No. 58) and jute sacks were used. Milling which was done every 30 days, continued up to ten months of storage. Three trials of 1000 grams each were made for each month and for each container.

RESULTS AND DISCUSSION

Experiment 1

Effect of moisture content at storage. Data in table 1 which shows the effect of moisture content at the start of storage on the percentage of milling constituents are far from critical because the different lots of rough rice stored at different moisture contents were not milled on the same dates as they were placed in mason jars on different dates. The milling, too, was not done at the same moisture content. It was observed that although the container used was sup-

[8] D. L. Umali, M. C. Silverio, and I. S. Santos, *Philippine Agriculturist*, **40**, 69 (1956).

TABLE 1.—*Milling constituents from Milfor 6 (2) rough rice stored in mason jars at different moisture content and milled eight months after storage*

DATE OF MILLING	MOISTURE CONTENT (PER CENT)		MILLING CONSTITUENT (PER CENT)					TEMPERATURE °F	RELATIVE HUMIDITY %
	At storage	At milling	Commercial rice	Brewers' rice	Rice bran	Hulls	Discrepancy		
August 16, 1956	19.8	14.4	57.67	4.04	13.70	22.85	1.74	80.4	77
August 23, 1956	17.5	14.9	57.52	2.27	12.78	25.38	2.05	80.9	82
August 23, 1956	15.7	15.4	61.48	2.27	11.28	23.75	1.22	80.9	82
September 5, 1956	13.6	13.5	65.02	2.37	9.75	22.33	0.53	83.0	76
September 14, 1956	11.5	13.1	65.72	2.37	9.40	22.47	0.04	80.5	81
October 5, 1956	9.8	11.1	61.00	7.85	11.20	20.62	−0.67	82.3	73
SMD at 0.05			1.02	0.39 [a]	0.85	1.24	[b]		
SMD at 0.01			1.44	0.55 [a]	1.19	1.75	[b]		

[a] Error variances for the different moisture contents were found heterogeneous. Separate *t*-tests were also calculated. Conclusions obtained were the same as those obtained from an analysis of variance.

[b] Not analyzed.

posed to be air-tight, rough rice stored at higher moisture content had reduced moisture content at milling. This could not be accounted for, but it is possible that the electronic moisture tester was not very accurate in determining the moisture content of the rough rice.

Storage at 19.8 and 17.5 per cent moisture content gave the lowest amount of milled or commercial rice; storage at 13.6 and 11.5 per cent gave the highest.

Data show that the low amounts of commercial rice were probably due to the high percentages of rice bran rather than preponderance of broken kernels. Storage at 13.6 and 11.5 per cent moisture produced the highest commercial rice output and the lowest percentage of rice bran. On this basis, it appeared that high commercial rice output was made possible mainly by removing less rice bran from the grain.

Percentages of rice hulls were not important in explaining high or low output of commercial rice. One case, however, indicated some irregularities. The percentage (25.38) of rice hull at 17.5 per cent moisture content was unusually high compared with the rest. Portions of brewer's rice and rice bran could have been included with the rice hull; this would explain the low percentage of rice bran at 17.5 per cent moisture content.

When and if it is definitely verified that commercial rice obtained from rough rice with higher moisture content is lower because of removing more rice bran, it may be feasible to recommend different adjustments for milling rough rice with different moisture content. With proper adjustments in the machine, a high output of commercial rice could be obtained from rough rice with high or low moisture content.

Percentages of discrepancy were all positive except one. Positive discrepancy indicates that the total weight of commercial rice, brewer's rice, rice bran, and hull is less than the weight of rough rice because of loss of moisture during milling and spilling of the milling constituents. On the other hand, discrepancy is negative when the rough rice has a relatively low moisture content and thus has a tendency to absorb moisture from the atmosphere. The percentage of discrepancy (2.05) at 17.5 per cent moisture content upset the algebraically decreasing trend. The percentages of discrepancy were so small that even if these were algebraically added to their respective commercial rice percentages, the relative values would not change appreciably.

Experiment 2

Effect of method of storage. There were neither significant nor appreciable differences among the amounts of commercial rice from rough rice stored in wooden boxes, cheese-cloth bags, and jute sacks. Wooden boxes gave 66.48 per cent commercial rice, cheese-cloth bags. 66.77 per cent and jute sacks, 66.43 per cent.

Experiment 3

Effect of length of storage. It is obvious that there was moisture restoration since the rough rice was stored at 11.5 per cent (table 2). The moisture content at milling of rough rice stored for ten months was inexplicably low (10.7 per cent).

There were highly significant differences in the amount of commercial rice from the different lengths of storage. Milling after four, five, and six months of storage gave high output of commercial rice. From the seventh to the tenth month after storage there seemed to be no decrease in the amount of commercial rice. The first sign of increase in the amount of commercial rice was observed on the third month after storage.

The increase in commercial rice output in the fourth, fifth, and sixth month after storage was somewhat abrupt and could not be explained on the basis of percentages of brewer's rice, rice bran, and hulls. Hence, it appeared that three-month storage in jute sacks of Milfor 6(2) rough rice at 11.5 per cent moisture allowed for "ripening" or "tempering" with a subsequent beneficial effect on commercial rice output.

Because mason jars are almost perfectly air-tight, rough rice stored in them showed little or no moisture restoration (table 3). There was a continuous increase in commercial rice output from the first milling (one month of storage) to the third milling (three months of storage). From the third to the tenth month of storage, there was no further increase in commercial rice output. These conclusions were in consonance with those derived from the jute sack series.

It is interesting to note that the percentage of discrepancy in these mason jar series were generally smaller than those in the jute sacks. The relative humidity for the first and second millings was somewhat lower than those for the rest, but it is difficult to find a way of using these to explain the much lower commercial rice output.

TABLE 2.—*Milling constituents from Milfor 6 (2) rough rice stored in jute sacks and milled one to ten months after storage*

DATE OF MILLING	NO. OF MONTHS AFTER STORAGE	MOISTURE CONTENT AT MILLING [a]	MILLING CONSTITUENT (PER CENT)					TEMPERATURE °F	RELATIVE HUMIDITY %
			Commercial rice	Brewers' rice	Rice bran	Hulls	Discrepancy		
March 21, 1956	1	13.3	65.57	3.95	7.43	21.33	1.72	79.6	56
April 20, 1956	2	13.0	65.13	4.93	7.37	20.63	1.94	84.1	60
May 20, 1956	3	13.6	66.37	1.80	10.17	19.93	1.73	83.6	76
June 19, 1956	4	14.1	67.35	2.25	7.03	22.07	1.27	83.0	70
July 19, 1956	5	14.3	67.02	1.13	8.17	22.43	1.25	82.7	78
August 18, 1956	6	14.8	67.47	1.30	7.98	22.33	0.92	82.4	76
September 17, 1956	7	14.9	66.30	1.70	8.70	21.55	1.75	79.4	79
October 17, 1956	8	15.0	66.43	1.93	8.68	20.73	2.23	80.8	73
November 16, 1956	9	15.4	66.58	4.33	9.63	18.37	1.09	82.8	88
December 16, 1956	10	10.7	66.58	3.78	9.83	19.07	0.79	78.4	90
Mean			66.48	2.70	8.50	20.84	1.48		
SMD at 0.05			0.96	0.67 [b]	0.86	—	[c]		
SMD at 0.01			1.31	0.91 [b]	1.17	—	[c]		

[a] Moisture content at storage was 11.5 per cent.
[b] Error variances are heterogeneous. Caution must be exercised in the use of these SMD's.
[c] Not analyzed.

TABLE 3.—*Milling constituents from Milfor 6 (2) rough rice stored in mason jars and milled one to ten months after storage*

DATE OF MILLING	NO. OF MONTHS AFTER STORAGE	MOISTURE CONTENT AT MILLING [a]	MILLING CONSTITUENT (PER CENT)					TEMPERATURE °F	RELATIVE HUMIDITY %
			Commercial rice	Brewers' rice	Rice bran	Hulls	Discrepancy		
March 21, 1956	1	12.0	65.87	3.55	8.03	21.20	1.35	79.6	56
April 20, 1956	2	11.1	66.73	3.83	7.13	20.80	1.51	84.1	60
May 20, 1956	3	11.5	68.83	1.70	8.93	20.33	0.21	83.6	76
June 19, 1956	4	11.7	69.17	1.25	7.22	21.78	0.58	83.0	70
July 19, 1956	5	11.9	69.30	0.93	7.60	20.70	1.47	82.7	78
August 18, 1956	6	11.8	69.55	1.03	7.37	21.80	0.25	82.4	76
September 17, 1956	7	11.8	69.55	1.43	7.57	21.07	0.38	79.4	79
October 17, 1956	8	11.8	69.52	1.40	7.53	21.00	0.55	80.8	73
November 16, 1956	9	12.8	69.40	3.30	8.23	19.02	0.02	82.8	88
December 16, 1956	10	12.1	69.97	2.97	7.97	18.90	0.19	78.4	90
Mean			68.79	2.14	7.76	20.66	0.65		
SMD at 0.05			0.56	0.38	0.38	0.85 [b]	[c]		
SMD at 0.01			0.77	0.52	0.51	1.14 [b]	[c]		

[a] Moisture content at storage was 11.5 per cent.
[b] Error variances are heterogeneous. Caution must be exercised in using these SMD's.
[c] Not analyzed.

Commercial rice output from the jute sacks and mason jar series are summarized in table 4. Means for each month (length of storage) and for each container and new SMD's based on the analysis of variance were computed. All the mean squares were highly significant. The highly significant mean square for month x container interaction indicated that the upward and downward trends in commercial rice output were not the same for both jute sack and mason jar. In spite of the interaction, there were highly significant differences among month means and between container means.

The conclusion obtainable from a glance at the month means was exactly the same as that obtained in the jute sack series, namely, that the increase in commercial rice output started from milling at three months of storage with no further increase up to ten months of storage.

Storage in the mason jars, on the average, resulted in about two per cent increase in commercial rice output compared to storage in jute sacks.

SUMMARY

A study on the effect of (1) moisture content of rough rice at storage, (2) container used for storing rough rice, and (3) length of storage upon the amount of milled or commercial rice from Milfor 6(2) rough rice gave the following results:

1. Millings of rough rice stored with 13.6 and 11.5 per cent moisture for eight months gave the highest percentage of commercial rice, 65.02 and 65.72, respectively. Increases of about seven per cent over millings of rough rice stored with 19.8 and 17.5 per cent moisture, and about three to four per cent, over rough rice stored with 15.7 and 9.8 per cent moisture were obtained.

2. There were no significant differences in commercial rice output among the lots of rough rice stored at 11.8 per cent moisture for eight months in the different containers. Cheese-cloth bags gave 66.77 per cent; wooden boxes, 66.48 per cent; and jute sacks, 66.43 per cent.

3. After two-month storage in jute sacks and after one-month storage in mason jars, an increase in commercial rice output for rough rice stored with 11.5 per cent moisture was obtained. There was no further gain or loss up to the tenth month of storage.

4. The ten-month period of storage in mason jars gave about two per cent more commercial rice than storage in jute sacks.

TABLE 4.—*Comparison of commercial rice output in per cent from Milfor 6 (2) rough rice stored in jute sacks and in mason jars and milled one to ten months after storage*

MONTH AFTER STORAGE	JUTE SACK	MASON JAR	MONTH MEAN [a]
1	65.57	65.87	65.72
2	65.13	66.73	65.93
3	66.37	68.83	67.60
4	67.35	69.17	68.26
5	67.02	69.30	68.16
6	67.47	69.55	68.51
7	66.30	69.55	67.93
8	66.43	69.52	67.98
9	66.58	69.40	67.99
10	66.58	69.97	68.28
Container means [b]	66.48	68.79	

[a] SMD between month means:
at 0.05 = 0.54 per cent
at 0.01 = 0.73 per cent
[b] SMD between container means:
at 0.05 = 0.24 per cent
at 0.01 = 0.32 per cent
SMD between container values within each month or between month values within each container:
at 0.05 = 0.77 per cent
at 0.01 = 1.03 per cent

Analysis of variance

SV	DF	MS	COMPUTED F-VALUE	SMD	
				0.05	0.01
Months (M)	9	5.83 [a]	27.76	0.54	0.73
Container (C)	1	79.93 [a]	380.62	0.24	0.32
M × C	9	1.28 [a]	6.10	0.77	1.03
Error	40	0.21			
Total	59				

[a] Significant at 0.01 level.

A STUDY OF IRISH POTATO VARIETIES IN SAN MATEO, RIZAL [1]

T. G. Cadiz and J. C. Acosta [2]

In a study comparing four foreign varieties of Irish potato with the Baguio potato variety, results showed that Japan No. 5 (recent accession) yielded 5.61 kg. per plot which is more than twice the yield of Baguio variety (2.45 kg. per plot). Japan No. 6, with a mean yield of 3.97 kg. per plot, was second highest.

Although Baguio variety (yellow fleshed) had the lowest yield it was the best in eating quality.

Potato is widely grown in Mountain Province and Cotabato where the climate is favorable for its growth. At present, the potato industry is faced with several problems, such as low yield, susceptibility to serious pests and diseases, lack of certified seeds for planting purposes, and poor adaptability of the available varieties. Very limited studies have been conducted in this country to solve these problems.

Selecting seed materials for planting from disease-free fields is the most feasible way to maintain the yielding ability of potato varieties. This is often not appreciated by inexperienced and non-discriminating farmers.

This experiment was conducted at San Mateo, Rizal from December, 1956, to May, 1957, to find among the available varieties the best as regards yield and eating quality.

Seed pieces of varieties Baguio Potato, Alpha A, Alpha B, Japan Nos. 5 and 6 were planted in the cooperator's farm on December 18, 1956. The first three varieties were obtained from the Bureau of Plant Industry Station at Baguio City and the last two

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were recent accessions from Japan through Mr. P. A. Rodrigo of the BPI Central Office, Manila. The hills were supplied with compost at the rate of five tons per hectare and complete fertilizer (12-24-12) at 700 kg./ha. at planting time. The varieties were completely randomized in blocks replicated four times, and planted in double-row plots five meters long with the hills about 30 cm. apart arranged in a triangular design. The trial was pump-irrigated and sprayed with Gycop and Endrin to control pests and diseases. Tubers from all the 18 plants per plot were harvested for yield data.

Sample tubers of the different varieties were boiled and taste tested for quality by using a rating scheme of 1—5, with 5 as excellent, 3—medium, and 1—poor.

The moisture content of the different varieties was also determined by oven-drying 10-gram samples at 110°F (37.6°C) for 24 hours.

The differences in yield of the different varieties were highly significant (table 1). Japan No. 5 outyielded the other varieties with a mean yield of 5.61 per lot. Japan No. 6 which yielded 3.97 kg. per plot was second best. Alpha B and Baguio Potato were the poorest yielders.

The tubers of the two Japanese varieties were in general larger than the other varieties. Baguio variety had only small tubers classifiable as mediums and smalls.

Although Baguio variety was the poorest yielder, it had superior eating quality over the varieties. Results of the taste test showed that it was firm, fine textured, and mealy. Being yellow fleshed it may be richer in carotene than the other varieties. The Japanese varieties were soggy and soft. Alpha A which is also yellow fleshed ranked second. The Alpha B variety had a very poor flavor. The test ratings (mean) of the five varieties were as follows: Baguio, 4.50; Alpha A, 4.17; Alpha B, 2.33; Japan Nos. 5 and 6, 3.17.

In moisture content, Alpha A had the highest, 79.6 per cent, Baguio variety and Japan No. 5, 78.3 per cent, Alpha B, 78.6 per cent and Japan No. 6, 77.0 per cent. Based on the above data, a soggy consistency in potato does not necessarily mean more moisture content than mealiness.

TABLE 1.—*Yield in kilograms per plot at San Mateo, Rizal* [a]

VARIETY	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
Baguio	1.82	2.70	2.47	2.82	9.81	2.45
Alpha A	3.10	3.31	3.76	4.60	14.77	3.69
Alpha B	1.96	1.41	4.07	3.23	10.67	2.66
Japan 5	6.09	4.67	7.02	4.68	22.46	5.61
Japan 6	4.08	3.94	4.03	3.84	15.89	3.97
Total	17.05	16.03	21.35	1917	73.60	
SMD .05						1.17
.01						1.65

* * *

The Filipino scientists of today and those who are sympathetic with their course of action have a great mission to perform. They should exploit every favorable turn of events for the sake of the advancement of science and the scientists. They should be alert to every opportunity that presents itself to improve the lot of the Filipino scientists. They should organize and systematize their group efforts to achieve effectively their purpose. They should attempt to create a more favorable social climate for the scientist so that proper recognition may be bestowed on the value of this contribution towards the social welfare. They should find means to raise the position of the scientist in the scale of our social values so as to divert some of the more able of our youth to the study of science. They should try to convince by their researches and their achievements as many of our leaders as possible of the indispensability of the scientist in the national effort to raise our living standards and to minimize the poverty of the masses.

—*E. T. Virata*

TWO RATIONS FOR LACTATING DOES [1]

V. G. Argañosa, L. L. Clamohoy, and O. A. Palad [2]

There were no significant differences in milk production between does fed with the College poultry laying mash with binlid (ration 1) and those with the College dairy ration (ration 2). Ration 1-fed does produced slightly higher amount of milk and butterfat, consumed more concentrates but gave less returns above feed cost than those on ration 2.

Dairy goats fed only with roughages are not expected to produce much milk because of the small capacity of their digestive systems to store the nutrients necessary for high milk production. Concentrates are good sources of such nutrients and to supplement the roughages which the does eat, a handful will supply their need for high milk production.

Fronda (1956)[3] observed that in Bangkok, Thailand, milking does were given a ration of laying mash consisting of 60 kilograms rice bran, 4.0 kilograms broken rice, 7.2 kilograms peanut cake, and 2.0 kilograms fish meal as grain mixture. Each animal consumed about one kilogram of the concentrate a day and in addition, about 2 liters of boiled broken rice (binlid) was given every afternoon. The concentrate cost ₱0.12 a kilogram and broken rice, ₱0.90. The soilage given daily to the does cost ₱0.30. The goats were reported to produce considerable amount of milk.

The College has long been using a dairy cattle ration composed of equal parts of ground yellow corn, fine rice bran, and copra meal for all herds. The feeding value of this ration has been found to be just as good as any experimental ration for milk production.

This study was conducted from November, 1956, to January, 1958, to find out the effects of the college dairy herd ration and the college poultry laying mash with binlid on the milk and butterfat productions, liveweight of lactating does, and on the feed cost of production for each ration.

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[1] Central Experiment Station Contribution No. 1978. Research Project No. 1045.

[2] The authors are grateful to former assistant instructors J. C. Madamba and A. S. Achacoso for their assistance in conducting this experiment.

[3] Fronda, F. M., *Agricultural and Industrial Life*, 1956.

MATERIALS AND METHODS

Twenty-five grade milking does were grouped according to age, stage of lactation, milk production, butterfat test, and body weight.

One group was given the college poultry laying mash with binlid which was designated as ration 1 and the other group, the college dairy herd ration designated as ration 2. Each ration was composed of the following:

Ingredient	*Parts by weight in kgm.*	
	Ration 1	*Ration 2*
Ground yellow corn	55.0	33.0
Fine rice bran	22.5	33.0
Copra meal	10.0	33.0
Fish meal	7.5	—
Soybean oil meal	5.0	—
Total	100.0	100.0
Binlid	100.0	—

The chemical analyses of the two rations follow:

Nutrient	*Parts in per cent*	
	Ration 1	*Ration 2*
Crude protein	11.86	7.99
Fat	.99	2.76
Fiber	3.75	4.55
N.F.E.	66.11	64.60
Moisture	13.00	11.90
Ash	4.29	8.20
Total	100.00	100.00

The does were milked at 7:00 o'clock in the morning and at 3:00 o'clock in the afternoon. They were hand-fed individually during milking time in individual milking stanchions. When the does were not being milked they stayed in the pasture to graze. The concentrate given per day was based on 1.0 per cent of the liveweight of the animal. The feed given and the refuse were weighed and recorded. The does were allowed pasture for their green forage between milking periods.

Milk production was recorded daily and a butterfat test was taken at the start, middle and end of each feeding period. The does

were weighed at the start and end of each feeding period. The experimental design followed for the first replication was

Group	*Period I*	*Period II*	*Period III*	*Period IV*
I	Ration 1	Ration 2	Ration 1	Ration 2
II	Ration 2	Ration 1	Ration 2	Ration 1

and that of the second replication was

Group	*Period I*	*Period II*
I	Ration 1	Ration 2
II	Ration 2	Ration 1
III	Ration 1	Ration 2

A third replication was conducted to verify the results obtained. The design was similar to that of the first replication except that it was only up to period II. The data obtained during the first week of each feeding period were discarded to avoid the after-effects of the previous ration.

RESULTS AND DISCUSSION

Milk and butterfat production. The does fed ration 1 produced more milk and butterfat than the ration 2-fed group. A total of 330.767 grams of milk testing 5.47 per cent butterfat was produced by ration 1-fed does while the does fed ration 2 produced 307,682 grams of milk testing 5.54 per cent butterfat. There were 17,810 grams butterfat produced by ration 1-fed group compared to 17,040 grams butterfat by does fed ration 2. Ration 1-fed does produced 23,085 grams more milk and 770 grams more butterfat than group 2 animals in three replications for a period of 168 days using 25 milking does in each group. These differences in milk and butterfat production when treated statistically were insignificant.

To make the comparison between the two rations equal, the milk production was standardized to 4 per cent Fat Corrected Milk using the following formula: 4 per cent F.C.M. $=$ (0.4 $\times$ total milk production) $+$ (15 $\times$ total butterfat production). This showed that the ration 1-fed group produced more milk than the ration 2-fed group in those replications. There was a difference of 20,797 grams more milk, which was found to be insignificant.

The higher milk and butterfat production of ration 1-fed groups in all the replications could be attributed to the ration being a better

mixture than ration 2 as shown by the chemical analysis. This could also be due to the fact that when the does were fed this ration they had a slightly bigger grain consumption.

Concentrate consumption and return above feed costs. As shown in the summary table, the does fed with ration 1 consumed a total amount of 160,712 grams of concentrate valued at ₱43.89 during the 168-day feeding period. The group fed ration 2 consumed 151,766 grams concentrate only valued at ₱29.91 for the same period. There was 8,946 grams more concentrate consumed by ration 1-fed does. The difference was ₱13.98.

The differences in consumption of the two rations were statistically insignificant in all replications. The slightly bigger consumption of ration 1 was obviously due to the variety of the ingredients contained in it which added palatability to the ration. Because of soybean oil meal and fish meal ingredients, ration 1 became slightly more expensive than ration 2.

At the College price of ₱0.55 a kilogram of milk, ration 1-fed animals would give a gross income of ₱181.92 and ration 2-fed does, ₱169.23 for the entire 168-day feeding period. The differences in favor of the ration 1-fed animals were ₱4.81, ₱5.82 and ₱2.06 for replications 1, 2, and 3, respectively.

The return above feed cost for the ration 1-fed group was ₱138.03 and ₱139.32 for ration 2-fed does or a difference of ₱1.29 for the entire period. The lower returns above feed cost in replications 1 and 3 for ration 1 may be attributed to the higher concentrate consumption of the animals and its higher cost than ration 2. During the second replication, the milk production in ration 2 was less by 10,584 grams than in ration 1.

Feed cost and production. A kilogram of ration 1 corresponds on the average to 2,139.0 grams of milk and 113.7 grams of butterfat. A kilogram of ration 2 corresponds to 2,095.2 grams of milk and 111.2 grams of butterfat. There were very slight differences in the amount of milk and butterfat produced for every kilogram of both rations in all the trials. The differences on the basis of one kilogram of feed were 43.8 grams of milk and 2.5 grams of butterfat in favor of ration 1.

The average cost of ration 1 to produce a kilogram of milk was ₱0.129 and ₱2.433 for every kilogram of butterfat. Ration 2 cost ₱0.094 to produce a kilogram of milk and ₱1.702 for every kilogram

of butterfat. The differences in cost of production, ₱0.035 for milk and ₱0.731 for butterfat, were statistically insignificant.

Body weights. The average initial weight of ration 1-fed does was 23.46 kilograms and average final weight was 23.22 kilograms, or a loss of 0.24 kilograms. Ration 2-fed does had an average initial weight of 23.18 kilograms or a loss of 1.05 kilograms.

SUMMARY

1. Twenty-five grade milking does grouped according to comparative age, stage of lactation, milk production, butterfat test, and body weights were used to find the effects of the college poultry laying mash with binlid (ration 1) and the college dairy ration (ration 2).

2. The experiment was conducted for 16 weeks in replication 1, eight weeks in replication 2 and eight weeks in replication 3 under a reversal type of feeding.

3. The results were as follows: Ration 1-fed does produced 330,767 grams of milk, 17,810 grams of butterfat and 399,458 grams of fat corrected milk (F.C.M.); Ration 2-fed does produced 307,682 grams of milk, 17,040 grams of butterfat and 371,661 grams of F.C.M.

4. Ration 1-fed animals consumed 160,712 grams of concentrate valued at ₱43.89 and ration 2-fed group, 151,766 grams of concentrate valued at ₱29.91.

5. The gross income received from ration 1-fed does was ₱181.92 and the return above feed cost was ₱138.03. Ration 2-fed does gave ₱169.23 income with ₱139.32 return above feed cost.

6. A kilogram of ration 1 produced 2,139.0 grams of milk and 113.7 grams of butterfat; ration 2 produced 2,095.2 grams of milk and 111.2 grams of butterfat.

7. The concentrate cost to produce a kilogram of milk was ₱0.129 for ration 1 and ₱0.094 for ration 2, whereas, the cost of producing a kilogram of butterfat was ₱2.433 for ration 1 and ₱1.702 for ration 2.

8. The ration 1-fed does lost 0.024 kilogram in body weight and ration 2-fed does, 1.05 kilograms during the experiment.

9. There were no significant differences between rations which tend to show that the quality of concentrate given to ruminants, like goats, does not matter.

Summary Table

ITEM	REPLICATION 1		REPLICATION 2		REPLICATION 3		TOTAL	
	Ration 1	Ration 2	Ration 1	Ration 2	Ration 1	Ration 2	Ration 1	Ration 2
Number of animals used	8	8	9	9	8	8	25	25
Length of feeding trial, days	84	84	42	42	42	42	168	168
Concentrate consumption, grams	81,912	77,258	39,438	36,689	39,362	37,819	160,712	151,766
Total feed cost, pesos	22.32	15.41	9.90	6.59	11.58	7.91	43.89	29.91
Total income from sales of milk, pesos [a]	82.60	77.79	45.65	39.83	53.67	51.61	181.92	169.23
Returns above concentrate cost, pesos	60.288	62.38	35.66	33.24	42.09	43.70	138.03	139.32
Total production, grams:								
Milk	150,188	141,429	82,998	72,414	97,581	93,839	330,767	307,682
Butterfat	8,612	8,520	4,096	3,545	5,102	4,977	17,810	17,040
4% fat corrected milk	189,257	184,372	94,639	82,110	115,562	112,179	399,458	378,661
Amount of milk produced per kilo of concentrate consumed, grams	1,833.5	1,830.6	2,104.5	1,973.7	2,479.0	2,481.3	2,139.0	2,095.2
Amount of butterfat produced per kilo of concentrate consumed, grams	105.1	105.5	106.5	96.5	129.6	131.6	113.7	111.2
Feed cost per kilo of milk produced, pesos	0.148	0.108	0.120	0.091	0.119	0.084	0.129	0.094
Feed cost per kilo of butterfat produced, pesos	2.591	1.808	2.438	1.710	2.270	1.589	2.433	1.702
Body weight, kilos:								
Average, initial	22.52	24.25	22.90	23.43	24.97	25.00	23.46	24.23
Average, final	23.50	23.77	21.26	21.10	24.90	24.68	23.22	23.18
Average, gain or loss	1.02	–0.48	–1.64	–2.33	–0.07	–0.32	–0.24	–1.05

[a] ₱0.55 a kilo of milk.

EFFECT OF TWO QUANTITIES OF GRAINS IN MILK PRODUCTION [1]

Bui Van Tro

The Holstein-Red Sindhi crossbred cows fed at the ratio of 1:3 (one kilogram grains for every three kilograms milk) produced in three 20-day periods 1721.8 kilograms of 4 per cent fat corrected milk while those fed at the 1:5 ratio produced 1525.1 kilograms. The corresponding average daily productions per cow were 7.17 and 6.35 kilograms. The differences due to the treatments were highly significant. However, the butterfat tests of the milk as well as the weights of the cows were not affected by the treatments.

One of the objectives of successful dairymen is to derive profits from their enterprises by feeding the milking animals all the roughage they can consume with the minimum amount of grains. This is because grain mixtures are expensive even if most of the ingredients used are by-products. It is estimated that dairy cattle are able to consume and utilize more than 70 per cent of their feed from roughage. However, it is recognized that feeding roughage alone to good milk producers is not sufficient to maintain maximum production even if the roughage contains high quality proteins and a great amount of total digestible nutrients.

Jensen *et al.* (1942) in a comprehensive study of input-output relationship in milk production reported that as more grains were fed, the cows ate less roughage, but total feed consumption when measured as total digestible nutrients increased with each additional input of grain; milk output increased at a decreasing rate when additional quantities of total digestible nutrients were fed. This is in contrast to feeding standards which provide for a fixed quantity of total digestible nutrients for each additional pound of milk production (Morrison, 1956).

Henderson *et al.* (1953) opined that the practice of feeding all cows in the milking herd the same amount of grain is costly because it usually underfeeds the best producers and overfeeds the

[1] Central Experiment Station Contribution No. 1979. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, March, 1958. Prepared in the Department of Animal Husbandry, under the direction of Research Assistant Professor Leopoldo S. Castillo.

low producers in the herd. As regards the amount of concentrate to be fed to dairy cows, Olson (1950) averred that the practical dairy farmer will benefit in his feeding practice if he adopts the ratio 1:3, that is, one pound of concentrate mixture for every 3 pounds of milk produced.

In the Philippines where the cost of grains is high, it would be of value to find out how two levels of grain feeding affect the milk production of milking cows. Hence, this study was conducted from December, 1956, to October, 1957, in the Dairy Division of the Department of Animal Husbandry, U.P. College of Agriculture.

MATERIALS AND METHODS

Eight Holstein-Red Sindhi crossbreds were divided into 2 groups of four cows each based on similarity of stage of lactation. The milk production in each group was equalized. At the start of the experiment, the cows in group 1 were fed grains at the ratio of one kilogram to three kilograms of milk produced and those in group 2 at the ratio of one kilogram to every five kilograms of milk produced. A double reversal design was followed. There were three comparison periods of 30 days each. The amount of feed given to any cow for the day was computed based on her milk production the day before. The cows were fed one-half of the grain ration in the morning and the other half in the afternoon. They were hand-milked twice daily.

To minimize the carry-over effects of the preceding treatments, the milk production during the first 10 days of the 30-day period of the change in the amount of grains given was not included in the analysis of variance of the data. In each case, the ten days served as a preliminary feeding period.

Composite three-day samples of the milk were taken at the start, middle, and end of each period and analyzed for butterfat. The butterfat yield for each period was computed using the average of the middle and end tests. The yield of 20 days was converted into 4 per cent fat corrected milk by the use of the formula of Gaines and Davidson (1923): FCM (4 per cent fat corrected milk) = 0.4x milk production + 15x fat. The cows in each group were allowed to graze on separate pastures having the same kind and stage of maturity of grasses, either Alabang X (*Andropogon nodosus* [Willem] Nash) or para grass (*Panicum purpurascens* Raddi). Forage consumption was estimated by using wire cages, 2 × 2 × 1.5 meters placed in the pasture before the cows were allowed to start grazing.

At the end of the grazing period, the grass in the cages was cut at about the height of the grass in the surrounding grazed area. The amount consumed by the cows was estimated by multiplying the average yield of grass per square meter in the cage by the area of the pasture division. Dry matter yields were also determined by drying 500-gm. samples in the oven at 70°C for 14 hours.

In no instance were the cows allowed to graze continuously in one pasture division for the duration of one comparison period of 30 days because the divisions were small. The cows were moved from one pasture to another depending on the growth of the grass in the grazed areas. The pastures were clipped as soon as the cows were moved.

The grain ration was composed of the following proportion:

Ingredient	*kilograms*
Corn gluten	20
Corn	15
Copra meal	35
Fine rice bran	28
Salt	1
Ground oyster shell	1
	100

The calculated digestible protein of the mixture was 14.22 per cent and the total digestible nutrients, 83.77 per cent.

The cows were weighed for three successive days at the start and end of each period to find out if they increased or decreased in weight due to the treatments. The three-day weights were averaged to get the initial and final weights for each period.

RESULTS AND DISCUSSION

Milk production. The cows fed grains at the ratio of one kilogram to three kilograms of milk produced 1710.00 kilograms of milk in 60 days (three 20-day periods); the cows fed one kilogram grains for every five kilograms of milk produced 1534.3 kilograms (table 1). There was a difference of 176.6 kilograms between the two levels of concentrate feeding. The analysis of variance of the production of the individual cows due to the treatments was highly significant at one per cent probability level.

TABLE 1.—*Milk production and feed consumption of eight dairy cows*

ITEM	GROUP 1 1:3	GROUP 2 1:5
Milk production:		
Total production in three 20-day periods, kg.	1710.9	1534.3
Av. daily production, per cow, kg.	7.13	6.39
Total fat corrected milk in three 20-day periods, kg.	1721.8	1525.1
Av. daily fat corrected milk, per cow, kg.	7.17	6.35
Av. butterfat test, per cent	4.06	3.96
Feed consumption:		
Total amount of grains for three 20-day periods, kg.	570.27	306.86
Av. daily amount of grains, per cow, kg.	2.38	1.28
Total amount of grass, for three 20-day periods, fresh basis, kg.	7610.8	7651.2
Av. daily amount of grass, per cow, fresh basis, kg.	31.71	31.88
Total amount of grass for three 20-day periods, dry matter basis, kg.	918.92	924.48
Av. daily amount of grass, per cow, dry matter basis, kg.	7.16	7.19

The average daily productions due to the treatments show that group 1 cows produced 7.13 kilograms of milk and cows of group 2, 6.39 kilograms.

The sequence of feeding group 1 cows for three periods was 1:3, 1:5, and 1:3. The corresponding amount of milk produced in 20-day periods was 570.2, 537.7, and 573.2 kilograms. In the sequence of feeding group 2 sows at 1:5, 1:3, and 1:5 ratios, the corresponding milk productions for each 20-day period was 536.0, 567.5, and 460.6 kilograms.

The 4 per cent fat corrected milk yield from each group showed similar response to that of the uncorrected yield. The analysis of variance showed highly significant differences due to the two levels of grain feeding. Group 1 cows produced 7.17 kilograms F.C.M. and group 2 cows, 6.35 kilograms F.C.M. daily. The results showed that the cows fed the limited grain produced 88.6 per cent as much as those fed the full grain ration.

There was no significant difference caused by the treatments on the butterfat tests of the milk. The cows fed with more grains gave an average butterfat test of 4.06 per cent. Those fed limited grains had a slightly lower butterfat test of 3.96 per cent. This is in agreement with Jensen *et al.* (1942) who reported that feeding grains at different levels had no influence on the fat percentage of the milk.

Feed consumption. The animals fed at the 1:3 ratio consumed 570.27 kilograms of the concentrate mixture in 60 days. Those on the 1:5 ratio consumed 306.86 kilograms. The average daily consumption of a cow in group 1 was 2.38 kilograms while a cow in group 2 consumed 1.28 kilograms. Based on the price of ₱0.161 a kilogram of the mixture, the cost of producing 7.13 kilograms of milk daily for those fed more grains was ₱0.382 and those in group 2, ₱0.206. Although feeding more grains costs a little more money the higher yield of milk will offset the high cost if milk is sold at the current local price of ₱0.55 a quart (0.9463 li/quart).

The average daily forage consumption of each cow in group 1 was 31.71 kilograms of either Alabang X or para grass and that in group 2, 31.88 kilograms. These estimates are higher than those reported by Mesina (1954)[2] of 21.9 kilograms of mixed soilage for Holstein cows and those published by McWilliam and Duckworth (1949) who stated that in Jamaica, cows whose average weight was 825 lbs. consumed 51.3 lbs. of elephant grass (Napier) soilage.

The dry matter content of the grasses was 22.58 per cent for group 1 and 22.55 per cent for group 2. This similarity was expected because the cows grazed on the same kind of grass at the same stage of maturity.

It was observed that the production of the cows which decreased when fed the limited grains (1:5) increased again when the same cows were given more grains (1:3) in the next comparative feeding period. This response was shown in both groups. Normally it is expected that as lactation advances, the milk production after it has reached its maximum at about two months after calving will drop gradually. Since the cows used had attained their maximum milk production, the results show that the additional amount of grains stimulated the cows to maintain the production for short periods. The following table substantiates the assertion that more than enough nutrients were provided by the additional grains for milk production and probably supplied sufficient lactation factors to cause the cows to respond favorably. The appendix tables of Morrison (1955) were used in the computation. The digestible protein of Alabang X, 0.69 per cent, and its total digestible nutrients, 41.70 per cent, as computed by Soliven (1955) may be used to substitute for para grass in the table.

[2] M. R. Mesina, "Soilage capacity of Holstein-Friesian and Brown Swiss cows." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1954. Unpublished).

Daily requirements of cows and nutrients from the feed

	D.P. *lbs.*	T.D.N. *lbs.*
Group 1		
Requirements:		
Maintenance of 810.92 lbs. (368.6 kgm.) cow	0.54	6.5
Milk, 15.6 lbs., butterfat test 4.06%	0.77	5.0
Total requirement, lbs.	1.31	11.5
Feed consumed: grains, 5.24 lbs. and para grass, 69.76 lbs.	1.44	14.8
Difference	+0.13	+3.3
Group 2		
Requirements:		
Maintenance of 806.96 lbs. (366.5 kgm.) cow	0.54	6.5
Milk, 14.04 lbs., butterfat test 3.96%	0.69	4.5
Total requirement, lbs.	1.23	11.0
Feed consumed: grains, 2.82 lbs. and para grass, 70.14 lbs.	1.10	12.9
Difference	−0.13	+1.9

Under the conditions of this study a grain-to-milk ratio of 1:3 is most profitable. One possibility which might be worthwhile looking into is to increase the digestible nutrients of the grain mixture.

SUMMARY AND CONCLUSION

1. Eight Holstein-Red Sindhi crossbred cows were used in a double reversal experiment of two groups of four cows each.

2. The cows fed at the ratio of 1:3 produced in three 20-day periods 1721.8 kilograms of 4 per cent fat corrected milk while those fed 1:5 gave 1525.1 kilograms. The treatments showed highly significant differences. The respective average daily productions of the cows were 7.17 and 6.35 kilograms.

3. The average daily forage consumption of each cow fed more grains was 31.71 kilograms of fresh grass while in the other group the consumption was 31.88 kilograms.

4. Although the cost of producing a given amount of milk was lowest on the 1:5 grain-to-milk ratio, the 1:3 ratio was much more profitable (263 kilograms of feed costing ₱42.34 produced an additional 176 kilograms of milk worth ₱96.00). Hence, the most profitable level at which to feed grain is dependent on the relative prices of concentrates and milk.

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A hundred mediocre or even average scientists, or even a thousand, cannot be equivalent to one first-rate man working in an environment where he has freedom to exercise his imagination.

—Dr. James R. Kilian

EFFECT OF UNDERDRAINAGE ON THE YIELD OF CORN AND THE RATE OF DROP OF THE WATER TABLE [1]

J. L. Ordoveza and P. L. Dano, Jr.[2]

WITH TWO TEXT FIGURES

The high position of the water table in the water-logged areas decreased the yield of corn. Close spacing of the tiles which resulted in better drainage increased the yield of corn.

The rate of drop of the water table was faster at the 25-meter spacing than at the 50-meter spacing irrespective of the kind of tile used. Data on the rate of drop of the water table of different tiles showed that there were no marked differences in their effectiveness in draining water-logged areas.

A comparison of the effects of these different kinds of tiles on the yield of corn regardless of their construction and material composition showed no significant differences.

In some parts of the Philippines, some of the water-logged areas are idle and others are cultivated but these do not give good returns. These areas could be converted into rich and productive land by removing the excess water. Excess water in the soil lessens aeration, discourages growth of beneficial microorganisms, and increases surface run-off and concentration of toxic substances. To farmers these constitute a great problem which can be solved by good and effective underdrainage.

Tile drainage is relatively new in this country. The U.P. College of Agriculture and Central Experiment Station, through intensive researches conducted in the Department of Agricultural Engineering, is trying to make available more information on this subject.

Excess water in the soil is removed through a continuous line of tiles laid at specific depths and spacings. Water entering through the tile joints flows down to the outlet by gravity.

For efficient performance of a tile underdrain, proper installation of the tiles with a specific slope, depth, and spacing of the tiles

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[1] Central Experiment Station Contribution No. 1980. Based on thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, October, 1957, under the direction of the senior author.

[2] The authors acknowledge the help of Professors A. P. Aglibut and A. B. Catambay and former Cornell Visiting Professor P. R. Hoff in conducting this experiment.

should be considered. In the latest study of tile underdrainage in the Philippines, Hoff *et al.* (1956)[3] found that 50-meter spacing in silty clay soil was too wide. They assumed that a spacing of 30 to 40 meters in similar soil would provide adequate sub-surface drainage. A drainage coefficient of one inch for 60 inches of rainfall was also recommended.

This study was conducted to determine the effective spacing of different tiles on Lipa clay loam soil as influenced by the rate of drop of the water table and rainfall intensity. The yield of corn was also considered. The work was undertaken from November, 1954, to September, 1957, at the Central Experiment Station underdrained area. One trial for each rainy season was made.

MATERIALS AND METHODS

Tile trenches were excavated by a tile trenching machine cutting a width of two feet and a depth of one meter following a minimum gradient of one per cent (Hoff *et al.*, 1956).[4] The length of the trench was 125 meters. The following materials and arrangements were studied: (1) two concrete tile lines, four inches in diameter, one-foot section, and spaced 50 meters apart; (2) two clay tile lines, four inches in diameter, two-foot section, and spaced 50 meters apart; (3) one line of bamboo tubes, three and one-half to four inches in diameter, two internode sections with septa removed, cured in the shade and treated with boiling oil, and spaced 25 meters apart; and (4) one bamboo blind pyramid drain tile line, inner nodes not removed, 20-foot lengths adding up to 125 meters, grouped in sixes, and spaced 25 meters apart. They were laid in the trenches to form a triangular cross-section (fig. 1). The slope of the tiles was maintained at one per cent.

Dried rice straw was placed above the tiles, tubes, and blind drains to a thickness of four inches so that upon its decay, it would provide a porous layer above the underdrains and thus hasten the passage of water to the tiles. Top soil from the top edges of the trenches was first used in partly filling the trench. The excavation spoils were used to complete the filling. All tile drains discharged into an outlet pipe, five feet long, six inches in diameter, and with a cast iron junction between the pipe and the drainage lines.

[3] P. R. Hoff *et al.*, *Jour. Soil Sci. Soc. Phil.*, **8**, 12-18 (1956).
[4] *Ibid.*

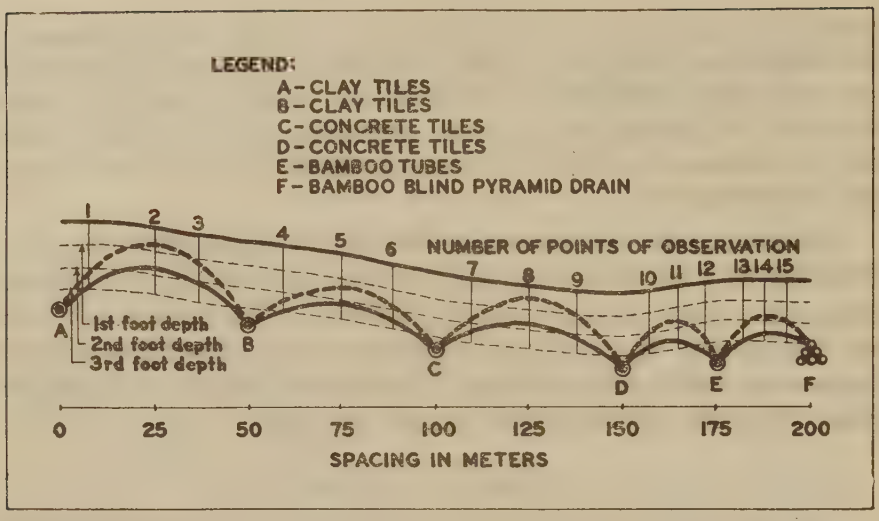
LEGEND:
A-CLAY TILES
B-CLAY TILES
C-CONCRETE TILES
D-CONCRETE TILES
E-BAMBOO TUBES
F-BAMBOO BLIND PYRAMID DRAIN
NUMBER OF POINTS OF OBSERVATION
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1st foot depth
2nd foot depth
3rd foot depth
A B C D E F
0 25 50 75 100 125 150 175 200
SPACING IN METERS

Fig. 1.—Diagram showing measurements of the rates of drop along points of observation.

Three rows of 78 observation wells were set in holes dug with a post-hole digger to a depth of one meter across the drainage lines. The wells were of two-inch diameter pipes, 107 centimeters long, perforated with four rows of one-half inch-diameter holes midway to the lower ends. These pipes were set vertically in each well. The wells were then filled halfway with gravel and finally with soil. Concrete tiles were placed on top of the wells to protect the exposed ends of the pipes. Spacing of all wells was from one to five meters with a closer spacing near or adjacent to the drainage lines.

The distance of the water table from the surface of the ground was measured daily with the use of a measuring gauge. The measuring gauge was inserted into the pipe and a voltmeter connected to two storage flashlight batteries registered as soon as the lower tip of the gauge touched the water. On the lower tip of the gauge were two poles, the anode and the cathode, which upon contact with water, completed the circuit. At the side of the measuring gauge was a meter stick where a direct reading of the depth of the water table from the surface was obtained. The average depth of the water table for every distance away from the drainage lines was taken from the mean of the first, second and third rows of observation wells. Average daily water table data were then plotted with the drawn profile of the land on a cross-section paper with the depth as the ordinate and the distance or spacing as the abscissa.

Three equally spaced points between underdrainage lines in the plotted water table were chosen. The soil profile was then divided into consecutive foot depths down to the underdrainage line. From these one-foot depth divisions, the distances of the water table from the top boundary of each foot depth were measured at the selected points with a scale. The differential decreases between the daily position of the water table at the selected points of every foot depth was considered the daily rate of drop of the water table. These rates of drop were averaged for each kind of tile. The average daily rate of drop of the water table for every kind of tile was obtained for every foot depth. The mean of the observed rates of drop was then plotted against every foot depth (fig. 2).

All the daily rates of drop and their corresponding rainfall intensities were averaged at every point of observation. All points of observation falling under the 50-meter spacing of tiles were separated from those that fell under the 25-meter spacing of tiles. The daily rates of drop and rainfall intensities under the 50-meter spacing and 25-meter spacing for all tiles were averaged for the rainy season. The rates of drop for all tiles were also averaged for every foot depth division.

Corn was planted in this area with a distance of one meter between hills and one meter between rows. The rows were located parallel to the underdrainage lines. Three equidistant rows were selected for every row with each hill thinned to two plants. No cultivation was done during the first planting because of the heavy rains. However, two cultivations were done during the second planting. At harvest, data on the average weight of husked ears per hill, average diameter of husked ears per hill, average number of rows of kernels per hill, and the average length of husked ears per hill were taken for every row. The yield of corn was expressed in cavans per hectare. All data from rows were averaged correspondingly for the clay tiles, concrete tiles, bamboo tubes, and bamboo blind pyramid drains.

RESULTS AND DISCUSSION

Rates of drop of different kinds of tiles. The rate of drop of the water table in inches per day is expressed as the drainage coefficient of the soil. The first and third foot depth divisions had almost the same rates of drop in clay tiles but in the concrete, bamboo tubes, bamboo blind pyramid drains there was a slight dif-

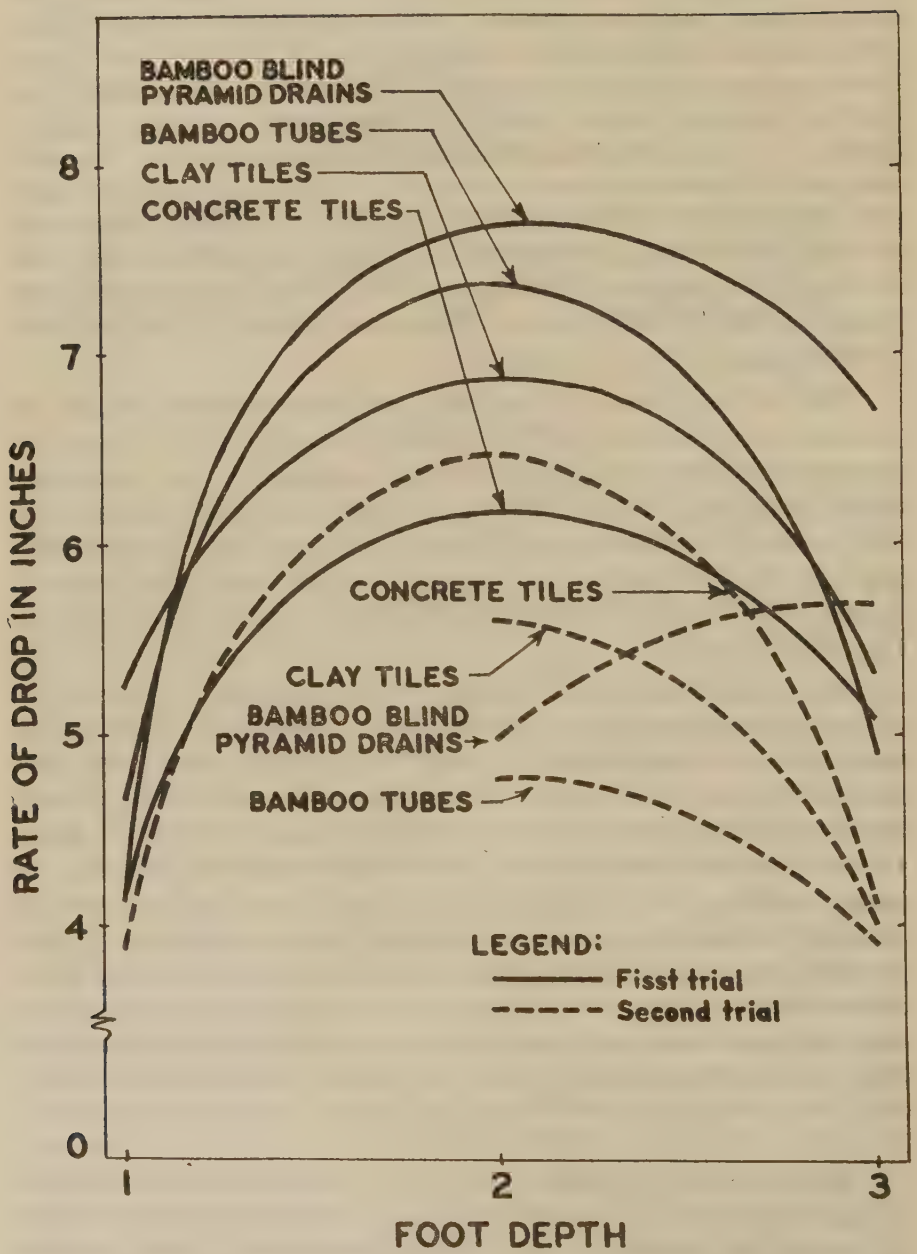

Fig. 2.—Average rate of drop in inches per day.

ference between the first and third foot during the first trial. A higher rate of drop for all tiles was observed in the second foot depth division in both trials. Mojica (1956)[5] and Vicente (1956)[6] who conducted a soil analysis of this area, reported the following data:

FOOT DEPTH	DESCRIPTION OF MOJICA	DESCRIPTION OF VICENTE
1st	Incorporated tuff and organic material, silty clay, structureless, moderately plastic and sticky, pH 6.2	Clay, moderately fine, medium sub-angular blocky, moderately plastic and sticky, pH 6.2 to 6.8
2nd	Silty clay, structureless (massive), moderately plastic and sticky, especially when wet, pH 6.2 to 6.4	Clay, moderately developed fine to very fine sub-angular blocky, plastic and sticky clear lower boundary, pH 6.8
3rd	Clay, fine to medium sub-angular block structure, moderately plastic and sticky, pH 6.2 to 6.8	Clay, very plastic and quite sticky, pH 6.8 to 7.2

Although the second foot depth is clayey and may suggest a low permeability, its blocky structure makes it actually more permeable than the first or third foot depths. Consequently, the rate of drop of water is higher in the second foot depth. Water percolates more easily through coarser soil particles than through fine soil particles because there are larger empty spaces for the water to occupy in bigger particles. Thus, the second foot depth provides better percolation than the first and third.

No observations were made on the first foot depth during the second trial because the water table did not reach the first foot depth. The insufficient amount of rainfall and the effective drainage by the tiles prevented the rise of the water table up to the first foot depth.

In both trials, the rate of drop of the water table decreased as the spacing of the tiles increased. The rates of drop in the 50-meter

[5] V. P. Mojica, "Texture and empirical physical constants of a poorly drained soil in the Central Experiment Station." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1956. Unpublished).

[6] P. R. Vicente, "Moisture-holding and supplying capacity of a poorly drained soil in the Central Experiment Station." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1956. Unpublished).

spacing were lower than those in the 25-meter spacing, even with a higher rainfall intensity. Although the same depth of rainfall fell on the 50-meter and 25-meter spacings, different readings in rainfall intensity were recorded. This was due to the position of the water table at the 50-meter spacing, which was higher than that on the 25-meter spacing and which was influenced by the accumulation of a small depth of rainfall. Only after a greater accumulation of rainfall depth will the lower water table of the 25-meter spacing be affected. It takes a longer time for the water to seep to a lower depth, and it is only after continuous rainfall for a certain length of time that a simultaneous rainfall effect can be noted on both the 50-meter and 25-meter spacings.

The rates of drop of the different tiles had no marked differences. This means that these kinds of tiles have almost the same effect in bringing down the water table.

Yield of corn. The different kinds of tiles had the same performance. The clay and concrete tiles showed no significant difference in their effect on yield at 50-meter spacing. The bamboo tubes, and bamboo blind pyramid drains showed the same effect. It seems, therefore, that all these tiles regardless of their material composition are effective in draining a water-logged area.

However, spacing of tiles had a direct effect on the yield of corn. During the first trial, the 25-meter spacing of tiles produced a greater weight of husked ears per hill than the 50-meter spacing. During the second season, however, there was no marked difference in the weight of husked ears per hill between the two types of spacings. There was a minor difference on the effect of spacing in yield because there was less rainfall during the second trial.

FARM MANAGEMENT STUDY IN DUC-HOA, LONG-AN, VIETNAM [1]

PHAN CONG CAN [2]

Of the 98 farmers interviewed for this study, 58 per cent were tenants, 35 per cent, owners and 7 per cent, part-owners. Their average age was 40.1 years. The average length of schooling they had was 3.1 years. On the average they had been residing in the village for 40.2 years and had been engaged in farming for 20 years.

The average size of farms was 2.7 hectares. The yield per hectare for rice was 49.8 cavans; sugar cane, 35.5 tons; pineapple, 12,804 fruits; and cassava, 10,700 kilos.

The average capital investment was ₱7,528 for owner-operators, ₱6,494 for part-owners and ₱4,165 for tenants. Average capital invested on rice farms was ₱7,463, with ₱4,400 on diversified farms, ₱5,044 on combination farms, ₱5,425 on pineapple farms, ₱3,265 on sugar cane farms, and ₱3,144 on cassava farms. Farm receipts averaged ₱1,161 and farm expenses, ₱677 on all farms.

Operator's farm labor earnings averaged ₱607 for all farms and family income from all sources, ₱1,203.

There was a direct relationship between size of farm, experience in farming and educational attainment to the different measures of profits.

Landlords and relatives provided the main source of agricultural loans. The average interest rate was 53 per cent per annum.

No form of farmers' organization existed in the area.

Vietnam's economy which rests primarily on agriculture needs to be restored and improved because of the destruction brought about by the last World War and Civil War. The government is seeking ways by which basic crops can be grown efficiently and profitably. But every program of the government to increase production and help farmers is handicapped by the lack of information about the farms and the farmers operating them. It seems evident that unless more and reliable information is gathered, farmers can not be properly guided in making profitable changes in their farming.

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[1] Central Experiment Station Contribution No. 1981. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, June, 1958. Prepared in the Department of Agricultural Economics under the direction of Assistant Professor Basilio N. de los Reyes and Visiting Professor Horst von Oppenfeld.

[2] The author is grateful to the International Cooperation Administration for financing his studies in the Philippines and to the Council on Economic and Cultural Affairs, Inc., New York, for sending Prof. de los Reyes to Saigon to assist in the initial phase of field work.

THE STUDY

Data on the farming operations of 98 farmers in Duc-Hoa, Long-An, Vietnam were obtained through personal interview in April and May, 1957. Data collected for the crop year 1956-1957 were recorded on schedules prepared under the supervision of the advisers. Analysis of the data was made at the Department of Agricultural Economics, U.P. College of Agriculture, from June, 1957, to May, 1958.

THE AREA

Duc-Hoa is about 30 kilometers northwest of Saigon, the capital city of Vietnam. The main crops raised in this area are rice, pineapple, sugar cane, cassava, and peanuts. Peanuts and vegetables are grown either before or after the rice crop.

Farmer's houses are scattered all over the area. Most of them are located around the town, along the provincial roads and along the river which separates Duc-Hoa from the adjoining town on the southwestern part.

THE OPERATORS

Tenure. Ninety-eight farmers were interviewed. Fifty-eight per cent were tenants, 7 per cent were part-owners and 35 per cent were owners.

Of the 41 farm owners, 21 acquired their land by purchase. The others inherited theirs from their ancestors.

Characteristics of farm operators. Farmers' ages ranged from 20 to 65 years. The average age was 40.1 years (table 1).

TABLE 1.—*Characteristics of 98 farm-operators by tenure*

ITEM	TENANT	PART-OWNER	OWNER	ALL OPERATORS
Age of operators	37.5	42.4	44.2	40.1
Years of schooling	2.3	3.6	4.3	3.1
Operator's family and household				
Number of children	4.4	5.4	4.6	4.6
Number in the household	6.8	7.6	7.1	6.9
Operator's time				
Months worked on farm	2.0	3.3	1.9	2.0
Months worked off farm	3.1	2.9	1.8	2.6
Months not gainfully employed	6.9	5.8	8.3	7.4

On the average, tenants were about six years younger than owner-operators. Owner-operators spent more years in school than either part-owners or tenants. The average household for all farmers had about 7 members. Part-owners spent more time working on the farm than the owner-operators or tenants. Tenants spent more time working on off-farm jobs as hired laborers.

Farmers' experience and mobility. On the average, operators have been residing in the village about two years longer than part-owners and about six years longer than tenants. They also have more experience in farming (table 2).

TABLE 2.—*Farmers' experience and mobility*

TENURE	AVERAGE NUMBER OF YEARS		
	Residing in the village	Engaged in farming	Operating present farm
Tenants	37.5	16.8	6.5
Part-owners	42.4	21.4	8.7
Owners	44.2	25.0	8.2
All operators	40.2	20.0	8.1

Part-owners have been operating their present farms longer than the owner-operators. Apparently, the land that the owner-operators are working on was acquired more recently.

THE FARM

Characteristics of farms. The average size of all farms was about 2.7 hectares (table 3). Of this, 2.5 was devoted to crop production. This is almost three times as big as that reported by Canh [3]

TABLE 3.—*Characteristics of farms by tenure*

ITEM	TENANT	PART-OWNER	FARMS	ALL OWNER
Number of farms	57	7	34	98
Farm area (hectares)	2.0	3.8	3.4	2.7
Hectares of cropland	1.9	3.7	3.2	2.5
Per cent of double cropping	16	6	16	14
Value of cropland per hectare [a]	₱1,364	₱1,296	₱1,337	₱1,339

[a] One peso = 17.5 piasters.

[3] Truong Quang Canh, "Farm Management in Hoavien Village, Photrach Canton, Province of Thua Thien (Central Region of Vietnam)." (Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, March, 1958. Unpublished).

in Central Vietnam. This is due to the fact that land is more abundant in the south than in either Central or North Vietnam. Part-owners had the largest farms, and owners and tenants, the next largest. The rate of double-cropping was much higher on tenant-operated farms.

The average value per hectare of land was about ₱1,339.

Relation of experience to size of farms. Robertson and Tablante,[4] observed that there is a tendency for size of farms to increase with the amount of farm experience. The same relationship was observed in this study. The more experienced farmers had larger farms.

Type of farming. Most of the farms were classified as rice and diversified farms (table 4). Most of the rice fields were double-cropped with peanuts and other vegetables. Some farmers raised poultry and swine in the farmstead.

TABLE 4.—*Gross farm income from major crop by type of farm*

TYPE OF FARM	NUMBER OF FARMS	AVERAGE PERCENTAGE OF GROSS FARM INCOME OBTAINED FROM MAJOR CROP
Rough rice	34	64
Diversified	31	33
Combination of two enterprises	10	43
Pineapple	11	75
Sugar cane	9	85
Cassava	3	73
All farms	98	55

Pineapple, sugar cane and cassava farms were highly specialized. The average gross return from the crops of the different farms ranged from 73 to 85 per cent of the gross farm income.

Area planted to different crops per farm and production rates. Rice is the principal crop in the area. The average area planted to rice per farm was 2.7 hectares (table 5). The average yield per hectare of lowland rice was 49.2 cavans, about 6 cavans higher than that reported by Canh [5] for the first season crop and about 16 cavans higher than that of the second crop. The average area planted to

[4] L. S. Robertson and N. B. Tablante, *Philippine Agriculturist*, **38**, 48 (1954).
[5] *Ibid.*

TABLE 5.—*Area planted to different crops per farm and production rates*

CROP	NUMBER OF FARMS GROWING	HECTARES PER FARM GROWING	AVERAGE YIELD PER HA.
Rough rice	73	2.7	49.2 (cavans)
Sugar cane	12	1.4	35.5 (tons)
Pineapple	11	2.4	12,804 (fruits)
Cassava	5	1.0	10,700 (kilos)
Peanuts	16	0.5	50.8 (cans)[a]

[a] One can has a capacity of five gallons.

pineapple per farm was 2.4 hectares. The yield per hectare was about 12,804 fruits. The average area planted to sugar cane per farm was 1.4 hectares. The yield for sugar cane was 35.5[6] tons per hectare.

Minor crops grown were cassava, peanuts, bananas, eggplants, tobacco, hot pepper, squash and pumpkin. Having a greater demand in this area, peanuts were planted to larger areas than the other minor crops.

Labor input. Total man-days spent per farm was lowest on diversified farms and highest on pineapple farms. On a per-hectare-effective-crop-area basis, labor input was lowest on palay farms and highest on cassava farms. On the average, a farmer spent 38.4 man-days per hectare on palay farms, 188.5 man-days per hectare on sugar cane farms, and 202.2 man-days per hectare on cassava farms (table 6). Labor input on cassava farms was higher than on the sugar cane and pineapple farms, because the latter types of farms had some ratoon crops which saved the farmers' time in land preparation and planting.

TABLE 6.—*Labor input by type of farming*

TYPE OF FARM	AVERAGE SIZE	TOTAL MAN-DAYS	
		Per farm	Per hectare
Rough rice	3.7	159.5	38.4
Pineapple	2.5	430.0	161.0
Diversified	2.1	105.2	48.3
Combination	2.6	152.1	55.1
Sugar cane	1.4	261.8	188.5
Cassava	1.4	303.3	202.2
All farms	2.7	184.3	63.4

[6] The yield of sugar fields at Duc-Hoa and its neighboring villages was estimated at 40 tons per hectare by the "Vietnam Sugar Company."

DISTRIBUTION AND REQUIREMENTS OF LABOR

Distribution of farm labor. Labor requirements on all types of farms were highly seasonal. Much labor on the farm was required for land preparation, planting and harvesting. For upland farms, the peak labor months were April, May and June when planting and harvesting were done (table 9 and figure 2). Highest labor requirements on one-crop rice farms and rice with other crops were during July, August and December. The other crops kept the operators busy after the harvesting period until the next planting season. Two-crop rice farms required much labor in December when the harvesting of the first crop and the planting of the second crop were performed simultaneously (table 7).

TABLE 7.—*Labor distribution on 98 farms by type of farm*

MONTH	MAN-DAYS PER FARM			
	Upland farm [a]	Rice (one-crop)	Rice (two-crop)	Rice with other crops
April, 1956	81.1	1.1	1.3	14.5
May	46.5	9.1	11.1	7.7
June	50.2	16.3	22.8	10.6
July	18.4	27.0	7.2	19.2
August	21.2	27.0	3.6	22.4
September	24.8	8.4	14.4	8.7
October	12.8	0.3	30.0	0.3
November	8.4	18.5	11.8	6.9
December	21.4	25.4	0.8	21.0
January, 1957	14.1	1.6	11.1	7.5
February	26.2	—	6.6	5.8
March	10.8	—	—	3.8
Total	335.9	134.7	120.7	126.4

[a] This includes pineapple, sugar cane and cassava farms.

Labor requirements. The first crop of rice required a total of about 38.3 man-days per hectare; the second crop, 41.3 man-days (table 8). Land preparation, transplanting and harvesting were the three operations that required much labor for the first crop. It took only 5.3 man-days to prepare the land for transplanting for the second crop. In most cases, they cut the remaining rice straw and then harrowed the field. However, more labor was required in transplanting and harvesting because the fields planted to second crops were generally small and operations could not be done efficiently as on large farms.

TABLE 8.—*Labor requirement by operation on 73 rice farms*

OPERATION	MAN-DAYS PER HECTARE	
	Second crop	First crop
Seed-bed preparation	1.6	2.6
Sowing	0.2	0.2
Land preparation	—	5.3
Repairing dikes	1.5	—
Plowing		
First	3.4	—
Second	3.3	—
Harrowing		
First	1.0	—
Second	1.0	—
Transplanting	9.8	15.0
Cultivation [a]	3.8	4.2
Harvesting	12.7	14.0
Total	38.3	41.3

On upland farms, land preparation required high initial labor. It took 267.5 man-days to cultivate one hectare of the first crop of sugar cane, and 210 man-days for pineapple. Ratoon crop of sugar cane required 134.1 man-days and for pineapple, 149.5 man-days. Cassava farms required 194.9 man-days for each hectare.

FARM FINANCIAL BUSINESS

Capital investment. (a) *By tenure.* Farm capital for all farms averaged ₱5,503. Owners had the largest capital investment per farm. They had better homes and more work animals than part-owners and tenants. Tenants owned 34 per cent of the total investments in the farm and part-owners, 52 per cent (table 9).

TABLE 9.—*Capital investment by tenure*

ITEM	CAPITAL INVESTMENT PER FARM			
	Owner	Part-owner	Tenant	All farms
	pesos [a]			
Land				
Landlord	—	3,110	2,768	1,832
Operator	4,736	1,747	143	1,851
Work animals	476	310	161	281
Other livestock	220	146	140	168
Dwelling	1,726	906	775	1,114
Other buildings	62	52	50	54

Tools and equipment	299	207	116	186
Feed and supplies	9	16	12	17
Total capital	7,528	6,494	4,165	5,503
Per cent capital owned by operator	100	52	34	57

[a] One peso = 17.5 piasters.

(b) *By type of farming.* Rice farmers had the highest investment (table 10). They had more investments in land and dwelling. The rice farmers had houses of strong material. Each house is surrounded by an orchard which supplies the fruits and legumes. The cassava farmers had the least capital investment per farm. They have no investment on work animals although they invested a little on houses and equipment.

TABLE 10.—*Capital investment by type of farming*

ITEM	CAPITAL INVESTMENT PER FARM						
	Rice	Diversified	Combination	Pineapple	Sugarcane	Cassava	All farms
Number	34	31	11	10	9	3	98
				pesos [a]			
Land							
Landlord	2,091	1,064	2,320	2,499	2,152	1,810	1,832
Operator	2,986	1,361	1,129	1,847	438	705	1,851
Work animals	361	417	234	—	—	—	281
Other livestock	205	198	254	55	21	26	168
Dwelling	1,544	1,016	799	937	595	522	1,114
Other buildings	59	66	82	27	13	25	54
Tools and equipment	203	250	197	60	46	41	186
Feeds and supplies	14	28	29	—	—	15	17
Total capital	7,463	4,400	5,044	5,425	3,265	3,144	5,503
Per cent capital owned by operator	78	76	54	54	34	48	67

[a] One peso = 17.5 piasters.

Farm receipts and expenses. The average farm receipts for all farms was ₱1,161 (table 11). Pineapple and sugar cane farms had more receipts than the others, because almost all of their crops were sold. The other farmers consumed a large portion of the crops produced, especially rice. Crops sold made up the greatest proportion of farm receipts followed by livestock and livestock products sold.

TABLE 11.—*Farm receipts and expenses by type of farming*

ITEM	RICE	DIVERSIFIED	COMBINATION	PINEAPPLE	SUGAR CANE	CASSAVA	ALL FARMS
Number	34	31	10	11	9	3	98
				pesos [a]			
Farm capital	7,463	4,400	5,044	5,425	3,265	3,144	5,503
Per cent owned by operator	72.0	75.8	54.0	53.9	34.1	42.4	66.7
Farm receipts							
Livestock & livestock products sold	139	188	261	50	55	41	146
Value of share in kind	137	35	46	—	—	—	64
Value of crop to landlord	80	38	75	—	—	—	47
Crop sold	708	411	484	1,863	1,584	806	805
Increase in inventory	98	114	59	7	12	—	78
Miscellaneous receipts	40	22	6	—	—	—	21
Total	1,202	808	931	1,920	1,651	847	1,161
Farm expenses							
Livestock bought	32	48	20	8	26	15	32
Value of crop to landlord	80	38	75	—	—	—	47
Value of shares in kind	137	35	47	—	—	—	63
Tools & equipment bought	11	17	4	9	11	8	12
Cash expenses	203	177	221	375	408	167	233
Hired man labor	107	41	115	592	394	333	174
Hired animal labor	7	8	14	—	—	—	7
Value of unpaid family labor	77	59	76	71	69	25	68
Decrease in inventory	51	30	24	50	46	63	41
Total	705	453	596	1,105	955	611	677
Net farm income	497	355	335	815	696	236	484

[a] One peso = 17.5 piasters.

The pineapple and sugar cane farms also had big expenses because of higher labor input and cost of fertilizers. Cash expenses and hired-man labor constituted more than fifty per cent of the farm expenses. The average expenses for all farms was ₱677.

Operator's net farm income. The gross farm receipts for all farms exceeded the total farm expenses. The net farm income is the remaining amount after the total farm expenses are deducted from the gross farm receipts. It is the amount that the farmers earn to pay for their labor and for the interest on the capital they have invested. Farm expenses include a charge for unpaid family labor.

The average operator's net farm income for all farms was ₱484.00 (tables 11 and 12). The net farm income from pineapple farms was the highest, followed by that from sugar cane farms. These two types of farms were highly specialized and commercialized. The other types of farms were more of the subsistence type.

TABLE 12.—*Measures of success of operators by type of farming*

ITEM	RICE	DIVERSIFIED	COMBINATION	PINEAPPLE	SUGAR CANE	CASSAVA	ALL FARMS
Number	34	31	10	11	9	3	98
				pesos [a]			
Operator's net farm income	497	355	335	815	696	236	484
Interest at 6% average capital	322	200	163	176	67	80	200
Operator's farm labor income	175	157	191	640	630	166	264
Farm privileges	445	393	337	256	162	193	363
Operator's farm labor earnings	620	550	528	896	792	359	627
Family's farm labor earnings	697	609	604	967	861	384	695
Other income	556	565	606	458	328	423	528
Family income from all sources	1,253	1,174	1,210	1,425	1,189	807	1,223

[a] One peso = 17.5 piasters.

Operator's farm labor income. The operator's farm labor income is what remains after deducting from the operator's net farm income six per cent interest on his capital investment. This rate is based on the percentage earned on the investment in land by leaseholders. This is a hypothetical cost because farmers do not actually pay interest for their investments.

The average operator's farm labor income for all farms was ₱264 (table 12). Pineapple and sugar cane farms had the highest operator's farm labor income.

Operator's farm labor earnings. The operator's farm labor earnings is obtained by adding the value of farm privileges to the operator's farm labor income. Farm privileges include the use of dwelling, livestock and livestock products and crops used at home. The use of dwelling is computed by taking 10 per cent of the average value of the dwelling. Sacay [7] emphasizes the importance of labor earnings

[7] Orlando J. Sacay, *Philippine Agriculturist*, **38**, 306 (1954).

as a good measure of success on farms where a large portion of production is for family use rather than for sale.

The average operator's farm labor earnings for all farms was ₱627 (table 12). Pineapple and sugar cane farms still had the highest operator's farm labor earnings, even with the small number of farm privileges as compared to other farms.

Family farm labor earnings. Farming is a family business. Members of the family help the operator in most farm jobs but are not paid for their work. The value of unpaid family labor was added to the operator's farm labor earnings to determine the family farm labor earnings which represents the returns both to operator's and family's labor. The family farm labor earnings averaged ₱695 for all types of farms (table 12).

Family income from all sources. The family income from all sources includes the operator's farm labor earnings, his off-farm income, the interest on average capital, family non-farm income and the value of unpaid family labor which was assumed as a cost in calculating the net farm income.

Family income from all sources averaged ₱1,223 for all farms (table 12). The pineapple and the rice farms had the largest amount available for family living. Sugar cane farms were next to rice in amount available for family living.

Comparison of income on 34 rice farms by tenure. Operator's farm labor income and operator's farm labor earnings were highest on tenant-operated farms. The average operator's farm labor income and operator's labor earnings was ₱175 and ₱620 for all rice farms, respectively (table 13). Owner-operators had the largest

TABLE 13.—*Measures of success on 34 rice farms by tenure*

MEASURE OF PROFIT	OWNER	PART-OWNER	TENANT	ALL FARMS
Number	13	4	17	34
		pesos [a]		
Operator's net farm income	637	505	381	493
Operator's farm labor income	5	254	292	174
Operator's farm labor earnings	616	616	624	620
Family's farm labor earnings	747	666	666	697
Amount available for family living	1,624	1,053	1,011	1,250

[a] One peso = 17.5 piasters.

amount available for family living. The average amount available from the rice farms for family living was ₱1,250.

Comparison of income on 31 diversified farms. Operator's farm labor income averaged ₱157 for all farms. Owner-operators had a larger amount available for family living than tenants because of larger capital investments and large other family non-farm income. The average amount available for family living was ₱1,174 for all diversified farms (table 14).

TABLE 14.—*Measures of success on 31 diversified farms by tenure*

MEASURE OF PROFIT	OWNER	TENANT	ALL OPERATORS
Number	14	17	31
		pesos [a]	
Operator's net farm income	452	278	357
Operator's farm labor income	136	174	157
Operator's farm labor earnings	565	537	550
Family's farm labor earnings	638	575	603
Amount available for family living	1,322	1,052	1,174

[a] One peso = 17.5 piasters.

FACTORS AFFECTING SUCCESS IN FARMING

Type of rice farms. The operator's farm labor earnings was highest on two-crop rice farms and lowest on farms raising livestock. Farms raising only one crop of palay had the highest amount available for family living and farmers raising two crops of rice had the lowest. Farmers raising one crop of rice increased their income by working on jobs other than farming (table 15).

TABLE 15.—*Income on different types of rice farms*

TYPE OF FARMING	NUMBER	OPERATOR'S FARM LABOR EARNINGS	FAMILY'S FARM LABOR EARNINGS	AMOUNT AVAILABLE FOR FAMILY LIVING
			pesos [a]	
Rice (one crop)	18	592	703	1,340
Rice (two-crop)	19	651	688	1,149
Rice with other crops	17	548	626	1,206
Rice with livestock	19	533	579	1,170
All farms	73	582	649	1,215

[a] One peso = 17.5 piasters.

Size of business. The size of business was in general positively related to the operator's farm labor earnings, family farm labor earnings and amount available for family living (table 16).

TABLE 16.—*Relation of hectares of cropland to the income of 98 farm-operators*

HECTARES OF CROPLAND	OPERATOR'S FARM LABOR EARNINGS	FAMILY FARM LABOR EARNINGS	AMOUNT AVAILABLE FOR FAMILY LIVING
		pesos [a]	
1 and below	501	524	903
1.1–2	616	676	1,100
2.1–4	604	670	1,396
4.1–7 above	936	1,111	1,770
All farms	607	674	1,203

[a] One peso = 17.5 piasters.

Rice farms were no exception to this general relationship. As the size of farms in the 54 one-crop rice farms increased, the earnings had the tendency to increase likewise.

Education. Farmers with higher education had a bigger amount for family living. The operator's farm labor earnings and family farm labor earnings, however, did not increase consistently with educational attainment (table 17). The tendency was for farmers with 6 years or more in school to have lower farm earnings.

TABLE 17.—*Relation of educational attainment to income, 98 farm-operators*

EDUCATIONAL ATTAINMENT	NUMBER	OPERATOR'S FARM LABOR EARNINGS	FAMILY'S FARM LABOR EARNINGS	AMOUNT AVAILABLE FOR FAMILY LIVING
			pesos [a]	
1 and below	8	451	484	876
2–3	62	603	657	1,074
4–5	21	777	869	1,550
6 and above	7	567	730	1,656
All farms	98	607	674	1,203

[a] One peso = 17.5 piasters.

Farmers with educational attainment of 6 years or more did not seem to fully utilize their efforts in farming; but instead they took off-farm jobs.

Experience. There was a direct relationship between farming experience and amount available for family living. There was also a direct relationship between other measures of income and farming experience up to 30 years. Beyond 30 years, income tended to decline. At this age farmers are a little old to manage their farms efficiently.

Rate of production. It was noted that for a higher yield per man equivalent, the profits were correspondingly higher, too. Crop yields had the greatest effect on income where crops provided the most important source of income.

OTHER FACTORS

Relation of size of farms to rate of double-cropping. There was a greater tendency for operators with smaller crop area to intensify their farms. Sixty-four per cent used double-cropping on their farms of one hectare and less, while eight per cent used the same on farms of 4.1 hectares or more. Double-cropping increases effective cropland where land is limited.

Relation of farm income to months of off-farm job. The months spent on off-farm work per operator were inversely proportional to the operator's farm labor earnings. Farmers with farm labor earnings of ₱343 had an average of 3.3 months of off-farm work, while those with ₱800 or more had only 1.6 months. Everybody has a minimum limit of expenses, and if his income falls below the set limit, he has to do some extra work to bridge the gap, while those who are supposedly well-to-do do not care about getting more income.

SHARING ARRANGEMENTS

Leasehold tenancy was the most common form of tenancy in the locality as in most parts of Vietnam. This means that a fixed amount of rent is paid for the use of the land. The rent varies, depending on the fertility of the soil, location of the field, and demand of land in the community. But the landholder can not charge a higher rent than that fixed by the government. This regulation was observed in most cases, because severe penalities are imposed on violators. The landlord's share, in terms of percentage of the gross income from the land, varied with the different types of farms (table 18). It was lowest on upland farms and highest on one-crop

TABLE 18.—*Rent to landlord as per cent of the income derived from the land, 67 lease-hold tenants*

TYPE OF RICE FARMS	NUMBER REPORTED	PER CENT
Rice (one crop)	17	19
Rice (two-crop)	12	13
Rice with other crops	11	15
Upland farms [a]	17	11
All farms	57	14

[a] This includes sugar cane, pineapple and cassava farms.

rice farms. Leasehold tenancy is believed to be a better arrangement for the operators, because they get full benefits from their increased efforts. However, this is disadvantageous in case of crop failure.

CREDIT PRACTICES

Sources of loans. Not all farmers had loans. Only 39 operators reported a total of 40 loans. Sixty-eight per cent of these loans were obtained from landlords and 15 per cent from relatives. The landlords occupied an important position in credit channels because they had funds to lend and they had as security the crops grown on their land. Farmers could not sell any part of their harvest until the full obligation had been paid. Relatives were also good sources of loans.

Repayment of loans. Fifty-seven per cent of the loans were fully repaid, 35 per cent partly repaid and 8 per cent unpaid. The percentage of unpaid loans was low, because most borrowers tried their best to fulfill their promises so that they could be extended loans again for the next season. There was no government agency that provided them with the credit they needed.

Rate of interest. The rates of interest varied from nothing to 120 per cent per annum, with an average of 53 per cent for all loans (table 19). These rates were excessively high, but farmers had no choice.

TABLE 19.—*Rates of interest*

RATE OF INTEREST		NUMBER REPORTED	PER CENT
class	*average*		
None	0	2	5
21–40	32	12	30
41–60	52	14	35
61–80	74	7	18
81 & above	99	5	12
Total	53	40	100

MARKET AND MARKET METHODS

There was a market at the center of the village which served the people of the area and of the neighboring villages.

Fruits, vegetables, poultry, and poultry products were carried by means of a bamboo pole over the shoulders to the market where they were sold to wholesalers or consumers. This was done by the farmers' wives only.

For rice and hogs, the buyers usually purchased them at the farmer's house.

Upland crops, such as sugar cane, pineapple and cassava, were sold by contract to brokers who undertook the harvesting themselves.

SOCIO-ECONOMIC CONDITIONS

Most farmers lived in small houses, with nipa roofing and palm leaves as walls right in their field. In some cases, walls were made of a mixture of clay and rice straw. The rich farmers had concrete houses located nearer the town, surrounded by a good orchard. The village had no running water and electricity, except at the center of the town. Water was fetched from the river, canals or wells.

Organization. There was no organization in the village for farmers. The residents were more concerned about their own security and their work. However, there were occasions such as anniversaries, wedding parties and political rallies, for them to get together.

* * *

The point before us is that this scientific field of thought is now, in the twentieth century, too narrow for the concrete facts which are before it for analysis. . . . Thus, in order to understand the difficulties of modern scientific thought and also its reactions on the modern world, we should have in our minds some conception of a wider field, of obstraction, which shall stand nearer to the complete concreteness of our intuitive experience.

—*A. N. Whitehead*

BOOK REVIEW: *SWINE FEEDING AND NUTRITION*

All those interested in swine production from beginners to established swine raisers, feed manufacturers and dealers, veterinarians, and students and teachers of agriculture will find *Swine Feeding and Nutrition* a very useful reference. The author, Tony J. Cunha, is professor and head of the Department of Animal Husbandry and Nutrition of the University of Florida. In preparing this book, he drew from his wealth of knowledge and experience as a swine husbandman and enriched this further with valuable suggestions of his contemporaries who are all eminent authorities in swine husbandry and nutrition. These include W. M. Beeson (Purdue), G. Bohstedt (Wisconsin), L. E. Hansen (Minnesota), S. W. Terrill (Illinois), R. F. Sewell (Georgia), G. E. Combs and H. D. Wallace (Florida).

The book is intended as the first volume in a series devoted to animal feeding and nutrition. It contains consolidated results of experiments in swine nutrition presented clearly, realistically and systematically. The author accomplished this by using concise and not-too-technical language, pertinent tabular matter and forty-six picture-illustrations showing nutritional deficiencies in swine. The text is also equipped with basic references for those interested in obtaining more information on various phases of swine production.

The first six chapters of the nine-chapter book summarize the needs of swine for the various nutrients—proteins, minerals, vitamins, fats, antibiotics, surfactants, etc.—and give the reader guideposts in preparing good and well balanced rations. These nutrient requirements are compared with those recommended by the National Research Council. The inclusion of methods of feeding them to swine gives these chapters great practical value.

The remaining chapters outline the relative value of foods, e.g., grain feeds such as corn, oats, wheat, barley, rice, rye and sorghums. The paragraphs on rice and corn will certainly benefit the Filipino swine raiser. Helpful pointers on feeding pigs at different stages of their development are discussed in detail. The author carefully points out the pro's and the con's of early weaning. Sample rations for all stages of the pig's development which may be worthwhile adopting experimentally in our country are given.

Without doubt, Cunha's book if studied carefully will contribute much to efficient and profitable management in swine production.

—*V. Villegas*

CORN-AND-COB MEAL IN A RATION FOR LAYING HENS

This study was conducted to find out if corn-and-cob meal can be used profitably to replace corn meal in a ration for laying hens under local conditions.

Sixty New Hampshire yearling hens were equally divided and randomly distributed into two lots. Lot I (control) birds were fed with the College standard laying mash while lot II (experimental) birds were fed with the same ration except for the complete replacement of corn meal with an equal amount of corn-and-cob meal. The birds in the two lots were individually weighed at the start of the experiment and at regular intervals. They were kept for one year in pens provided with sun porch.

At the end of the study, lot I birds were heavier by 0.17 kilogram over those of lot II. Also, statistical analysis showed that in percentage of egg production, the difference was significantly in favor of the control. The net profit in lot I was ₱60.19 and in lot II, ₱45.20. These results indicate that corn-and-cob meal is neither a satisfactory nor a profitable replacement for corn meal in rations for laying hens.

—F. L. Cortes and F. M. Fronda

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The scientists, all of them, have their duties no doubt, but they do not fully use their education if they do not try to broaden their sense of responsibility towards all mankind instead of closing themselves up in a narrow specialization where they find their pleasure. Neither engineers nor other scientific men have any right to prefer their own personal place to the happiness of mankind; their place and their duty are in the front of struggling humanity, not in the unperturbed ranks of those who keep themselves aloof from life.

—Korzyhski